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MAR 3 1931

ASA BULLETIN

FEBRUARY, 1931 NUMBER 58

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PUBLISHED MONTHLY FOR THE SUSTAINING MEMBERS OF THE AMERICAN STANDARDS ASSOCIATION, 29 WEST 39TH STREET, NEW YORK

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The Evaluation of Lubricating Oils by the Work Factor Method[1]

by

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A description of the method and apparatus used by the United States Navy in testing turbine, Diesel, and aviation engine lubricating oils

Lubricating oils for turbines, Diesel engines, and aviation engines may show by the standard tests to have properties that are in accordance with oils that are known to be satisfactory, yet they may be very unsuitable. Specifications for lubricating oils embodying the standard tests are of value when they cover a narrow range of oils made from a crude and by processes of refinement which are known to yield satisfactory oils, but when such specifications are used for oils made from widely different crudes or by widely different methods of refinement, their value is very doubtful. Lubricating oils, when obtained from various refiners having different crudes or different processes of refinement must, in order to insure safe and economical operation of machinery, be subjected to some test which will give true information of their suitability and the quality of the service to be obtained from them; in other words, the test must tell whether or not an oil is satisfactory for use and also properly evaluate satisfactory oils, in order that the consumer may be able to decide what oils are the most economical to purchase.

The suitability and evaluation of lubricating oils are believed to be very well accomplished by means of the work-factor evaluation method. This method is the result of the accumulation of information over a long period of time of the behavior of oils in service and their behavior when subjected to an endurance test which simulates service conditions. In reality it is an accelerated service test for lubricating oils carried out in a rugged machine, equipped with a test journal, which operates at a fixed speed and bearing pressure continuously for 100 hours without means for heating or cooling the oil. It is not the purpose of the endurance test to replace the standard tests for lubricants, but rather to increase the usefulness of these tests in determining the suitability of lubricating oils and in evaluating them.

[1] Presented at the Annual Meeting of the American Society of Mechanical Engineers, New York, N. Y., December 1–5, 1930.

Apparatus and Method of Test

The apparatus, as shown in Figures 1, 2, 3, and 4, consists of a machine steel journal *K* 6 in. long and 3.82 in. in diameter, which revolves in a split babbitt-metal bearing, the lower half of which is embedded in the base *A* and the upper half in the bearing cap *U*. The journal is directly connected to a flexible coupling *L* on the shaft of a 3½-hp motor *M*. The bearing pressure is applied to the bearing cap by means of four calibrated springs *D*. The revolutions of the journal are obtained from revolution counter *J*. The bearing cap is fitted with a pressure gage *H* and a mercury glass thermometer *F* for the purpose of ascertaining the oil-film pressure and the temperature of the bearing. The temperature of the oil to the bearing is obtained from mercury glass thermometer *E* inserted in a thermometer well in the inlet oil line *V* to the bearing. The oil to the bearing is supplied from the oil reservoir in the base *A* through the pump *O*. The oil reservoir is equipped with a gage glass *B*, filling connection *C*, and a drain plug *P*, in the oil line *R*. The driving motor *M* is calibrated and equipped with voltmeter and ammeter.

Five quarts of the oil to be tested are poured in the oil reservoir, through the filling connection. The oil is pumped from the reservoir to the oil groove in the bearing. The journal is then started, and the bearing pressure is equally and gradually applied by the springs until the nominal pressure of 150 lb per sq in. is obtained, when the speed of the journal is raised to 2000 rpm. The test is then started and run continuously for 100 hours, during which time hourly readings are taken of all the instruments. During the test all oils of the ultra-heavy grade (S.U.V. at 130 F 300–340) and heavier are fed at a pressure of 15 lb and lighter oils at a pressure of 10 lb. During

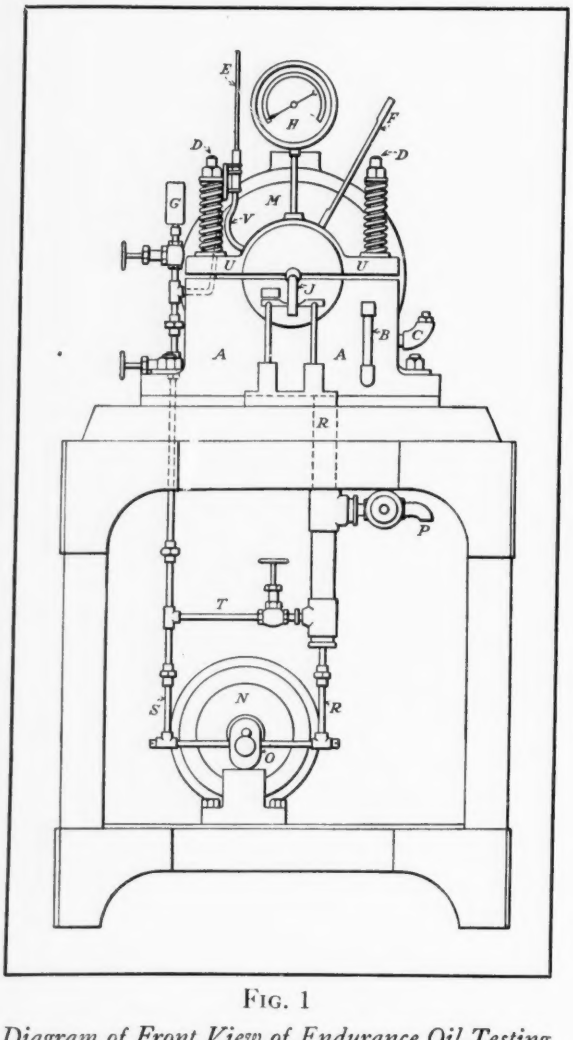


FIG. 1

Diagram of Front View of Endurance Oil-Testing Machine

the test the leakage loss of oil amounts to about 5.0 per cent, which leaves sufficient oil for the test. It is essential that no new oil be added during the test. The oil is examined before and after the test in order to determine the nature and extent of the changes in the oil during the test.

Work Factor

The foregoing test was developed in 1920, some of the results obtained being published in 1921.[2] Since that time a large number of tests have been conducted on oils using this method. The results of these tests have been used in determining the suitability of oils for naval use. All oils showing abnormal increases, when subjected to the test, in viscosity, acidity, asphaltic matter, and carbon residue, were rejected. These tests showed that acceptable oils did not increase beyond the following limits in these properties, when subjected to the test:

Viscosity	All oils below aviation oils in viscosity, per cent	20
	Aviation oils, per cent	25
Neutralization number		1.01
Precipitation number		1.01
Carbon residue, per cent	Oils of viscosity 190 sec at 130 F and below	1.05
	Oils of viscosity 190 to 340 sec at 130 F	2.05
	Aviation oils	3.05

In 1928, Keleher and McGeary[3] proposed a work-factor method of evaluating lubricating oil for forced-feed and motor-cylinder use, based upon the oil's behavior in the endurance test as regards increases in viscosity, neutralization number, precipitation number, and per cent of carbon residue. Since the publication of this article, slight changes have been made in the method of calculation of the work factor, and it is considered advisable to give a brief description of the method. Table 1 gives the Navy's classification of the oils, and Table 2 gives the limitations of the necessary characteristics for determining the work factor of these oils.

Table 1. U.S. Navy Classification of Oils

Navy symbol	*Commercial designation*	*Viscosity at 130 F*	*S.U.V. at 210 F*
1075	Refrigeration oil	65– 85	.....
2110	Light forced-feed and motor-cylinder oil	100–115	.....
2135	Medium forced-feed and motor-cylinder oil	125–145	.....
2190	Heavy forced-feed and motor-cylinder oil	180–200	.....
2250	Extra-heavy forced-feed and motor-cylinder oil	240–260	.....
2310	Ultra-heavy forced-feed and motor-cylinder oil	300–340	.....
3080	Winter aviation oil	75– 85	
3100	Summer aviation oil	90–100	
3120	Heavy aviation oil	115–125	

The viscosities of the new and used oils are taken at three temperatures, 100, 130, and 210 F, and the work value for the oil at each of the temperatures is calculated; the average of the three work values is the viscosity work value.

The formula used for oils 1075 to 2310, inclusive, is as follows:

$$\text{Work value} = 1.00 - \frac{\text{Final viscosity} - \text{initial viscosity}}{\text{Initial viscosity}} \times 5$$

[2] "Endurance Test of Force Feed Oils" by J. G. O'Neill, Associate, *Journal of the American Society of Naval Engineers*, Vol. 33, No. 2, May, 1921.

[3] "How the Navy Selects Its Lubricants" by Com. T. J. Keleher, U.S.N., and F. M. McGeary, *Manufacturing Industries*, August, 1928.

The formula used for oils 3080 to 3120, inclusive, is:

$$\text{Work value} = 1.00 - \frac{\text{Final viscosity} - \text{initial viscosity}}{\text{Initial viscosity}} \times 4$$

The neutralization number and precipitation number work values are each determined by the following formula:

$$\text{Work value} = \frac{\text{Final rejection point} - \text{Final content or content of used oil}}{\text{Final rejection point} - \text{Initial content or content of new oil}}$$

Table 2. Limiting Values for Work-Factor Determination

	Unused oil; initial rejection point	*Used oil after endurance test; final rejection point*
S.U.V. viscosities at 100, 130, and 210 F of oils 1075 to 2310, incl.	..	In excess of 20% increase
S.U.V. viscosities at 100, 130, and 210 F of oils 3080 to 3120, incl.	..	In excess of 25% increase
Neutralization number	0.11	1.01
Precipitation number	0.05	1.01
Carbon residue, per cent: Oils 1075 to 2190, incl.	0.55	1.05
Carbon residue, per cent: Oils 2250 and 2310	1.05	2.05
Carbon residue, per cent: Oils 3080 to 3120, incl.	1.55	3.05

The carbon residue work value is calculated from two formulas—one used for the oil when new and the other for the oil after the test, the average of the two being the carbon residue work value.

The formulas are as follows:

$$\text{Work value for new oil} = \frac{\text{Initial rejection point} - \text{Initial content}}{\text{Initial rejection point}}$$

$$\text{Work value for used oil} = \frac{\text{Final rejection point} - \text{Final content}}{\text{Final rejection point} - \text{Initial content}}$$

To obtain the average work value of the oil the foregoing results are assembled and expressed as follows:

Work-value viscosity at 100 F .....
Work-value viscosity at 130 F .....
Work-value viscosity at 210 F .....

$$(A)\ \text{Viscosity work value} = \frac{\text{Total of above work values}}{3}$$

(*B*) Neutralization number, work value .....
(*C*) Precipitation number, work value .....
Work value, carbon residue, new oil .....
Work value, carbon residue, used oil .....

$$(D)\ \text{Carbon residue, work value} = \frac{\text{New and used oil, work values}}{2}$$

Total (*A*), (*B*), (*C*), and (*D*) .....

$$\text{Average work factor of oil} = \frac{\text{Total of work values}}{4}$$

The highest work factor possible for an oil is 1.00. Where any of the foregoing work values is less than zero, a zero rating is given. An oil having an average work factor less than 0.50 is not considered suitable for use, nor is any oil which, when subjected to the test, exceeds any of the rejection points shown in Table 2.

Conditions Affecting Work-Factor Determination

In a previous paper,[4] there were discussed the work factors of lubricating oils made from different crudes, the lack of temperature control, reproducibility of results on different machines, and the consumption of lubricating oils in service which have different work factors.

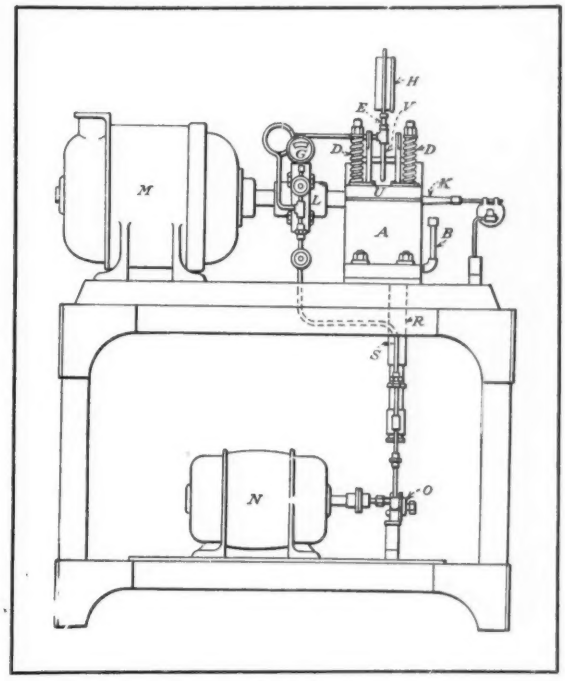


FIG. 2

Diagram of Side View of Endurance Oil-Testing Machine

Since this was published a lubricating oil was subjected to endurance tests in four different machines, all operating at the same time. The work factor for the oil from each machine was determined, and it was found that the results from all four machines varied less than 5 per cent. These tests were run during a hot summer month. Previously, the work factor of the same oil had been determined during a

[4] "Evaluation of Lubricating Oil by the Work-Factor Method" by J. G. O'Neill and F. M. McGeary, *National Petroleum News*, June 11, 1930.

cool fall month. It was found that the average work factor for the four runs during the summertime was 0.73 per cent greater than the work factor of the oil as determined in the fall month. Table 3 gives the results of the endurance tests of the oils, and in Table 4 are shown the calculated work factors of the oils and their properties after being subjected to the endurance test.

Table 3. Results of Endurance Test
(*Oil, Navy Symbol 2110*)

Test conducted in...	Oct., 1929	July, 1930			
Run on machine No.	3	1	2	3	4
Hours of test	100	100	100	100	100
Average speed of journal, rpm	2034	2008	2035	2020	1955
Average room temperature, F	75	86	86	86	86
Average bearing temperature, F	181	197	181	186	185
Average difference in temperature in F (bearing-room)	106	111	95	100	99
Average oil inlet temperature, F	143	156	161	133	143
Oil pressure to bearing, lb per sq in. gage	10	10	10	10	10
Bearing pressure, lb per sq in.	150	150	150	150	150
Oil film pressure, lb per sq in. gage	240	278	252	259	296
Coefficient of friction	0.0040	0.0040	0.0039	0.0036	0.0037
Condition of bearing at end of test	Bearing in good condition after all tests. No indications of scoring, corrosion, or formation of gummy deposits.				

In order to apply the bearing pressure, no clearance can be allowed between the test journal and the bearing. Therefore, the metals of the two members are separated during operation only by the thickness of the oil film. This means that the bearing must be in good condition and run in by means of bearing grinding compound. Immediate seizing will take place between the journal and bearing if the oil pressure ceases for an instant. Good mechanical condition of the endurance machine is necessary if proper results are to be obtained. When starting the test, care must be taken that the bearing pressure is gradually and uniformly applied.

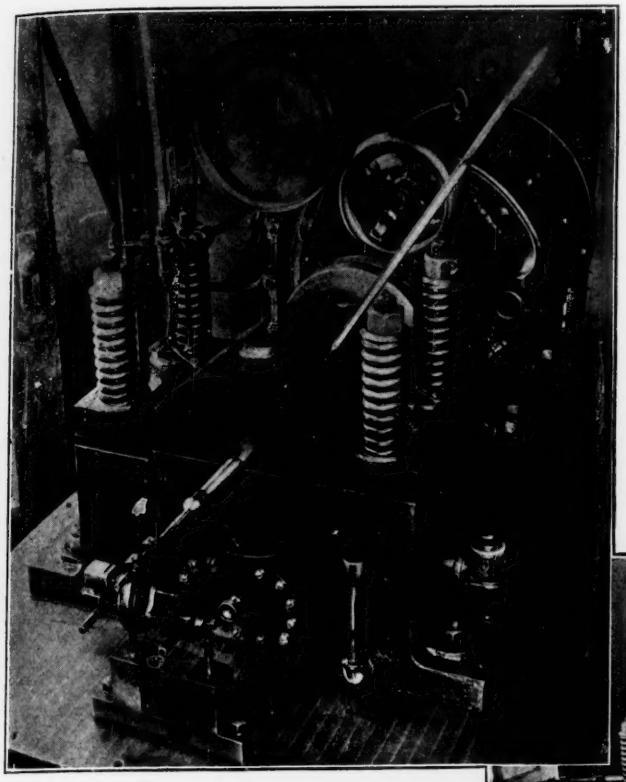
The endurance test offers a convenient means for study of various problems of lubrication, such as the effect on the oil of different bearing metals, the depreciation of the oil with excessive or scant flow of oil to the bearings, the effect of excessive vibration of the journals, and, possibly, the effect of different gases on lubricating oil during operation. It is believed that the solution of these problems will be greatly aided by means of the endurance test and the work factor.

Table 4. Properties of Oil after Endurance Test and Their Work Factors
(*Oil, Navy Symbol 2110*)

Test conducted in..	Oct., 1929	July, 1930			
Run on machine No.	New oil	3	1	2	3	4
A.P.I.	26.07	25.55	25.37	25.55	25.37	25.37
Flash point, open cup, F	335	340	340	340	340	340
Fire point, open cup, F	380	385	385	380	385	385
Pour point, F	5	5	5	5	5	5
Viscosity, S.U.V. at						
100 F	220	253	250	247	244	247
130 F	109	120	120	120	119	119
210 F	46	48 (Dil.)	48 (Dil.)	48 (Dil.)	48 (Dil.)	48 (Dil.)
Color, N.P.A.	1.5	3.0	3.5	3.0	3.0	3.5
Neutralization No.	0.06	0.16	0.19	0.19	0.19	0.19
Precipitation No.	None	None	None	None	None	None
Carbon residue, per cent	0.08	0.12	0.13	0.11	0.10	0.13
Work-Factor Determination						
Work value viscosity at						
100 F	...	0.250	0.318	0.387	0.455	0.389
130 F	...	0.495	0.495	0.495	0.542	0.542
210 F	...	0.783	0.783	0.783	0.783	0.783
(*A*) Viscosity work value	...	0.509	0 532	0.555	0.593	0.571
(*B*) Neutralization No., work value	...	0.894	0.863	0.863	0.863	0.863
(*C*) Precipitation No., work value	...	1.000	1.000	1.000	1.000	1.000
Carbon residue work value:						
New oil	...	0.854	0.854	0.854	0.854	0.854
Used oil	...	0.958	0.948	0.969	0.979	0.948
(*D*) Carbon residue work value	...	0.906	0.901	0.911	0.916	0.901
Total (*A*), (*B*), (*C*), and (*D*)	...	3.309	3.296	3.329	3.372	3.335
Average work factor	...	0.827	0.824	0.832	0.843	0.834

Work Factor of Turbine Oils

Turbine oils, as manufactured in the United States, show work factors from almost 1.0 to well below the allowable minimum of 0.50. The Navy, like most other large consumers of lubricants, purchases, in widely separated sections, lubricating oils which are made from different crudes and by different processes of refinement. In addition, there are many "freak" oils placed on the market, for which manufactures make marvelous claims. It is therefore necessary that definite information of the suitability and value be obtained of all oils offered for use. It is not practicable to submit all such oils to extended service tests; first, on account of the possibility of casualties, and, second, because of the time and expense involved. Before an oil is placed aboard ship for a service test, there must be confidence that it will give satisfactory service. If an oil during its endurance test increases abnormally in viscosity, in per cent of carbon residue, in acidity, and in "sludging" matter, it is but a matter of good judgment not to submit such an oil to a service test, but to reject it.



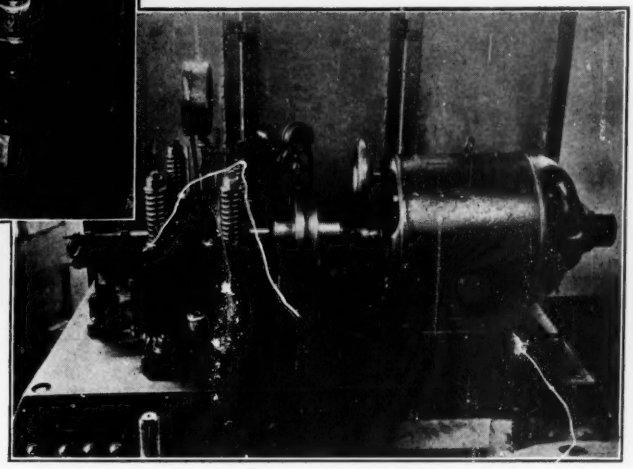


Figure 3 (Above) and Figure 4 (Right) Showing Front and Side Views of Endurance Oil-Testing Machine.

In the early days of the endurance test, year of 1924, a heavy turbine oil was submitted to be tested for naval use. The standard tests for physical and chemical properties indicated the oil to be of such excellent quality that it was sent aboard ship before being subjected to the endurance test. The endurance test of the oil was then run, and it was found to have a work factor of 0.32. The report from the ship stated that the oil became thick and heavy, seriously reducing the flow of oil through the gravity flow boxes, also depositing a heavy sludge, the oil purifier separating out 50 gallons of sludge out of a total run-through of 600 gallons. A sample of the sludge was analyzed and found to contain 28 per cent oil, 38 per cent water, and 34 per cent asphaltic matter.

The results obtained from the use of the endurance test in the testing of turbine oils have been so satisfactory that there is a growing conviction that this test is more reliable in indicating the quality of an oil than a single service test. Conditions may arise during a service test which may have a deleterious effect on the oil, for which the oil is not responsible; in an endurance test this is not so possible.

Diesel-Engine Lubricating Oil

The lubricating oil in use in Diesel engines undergoes the following changes:

With engine in good condition, piston rings tight, and combustion satisfactory:

Increase in specific gravity. Flash and fire points and pour point not much affected.

Increase in viscosity, neutralization number, precipitation number, and per cent of carbon residue, to practically the same extent as encountered in a lubricating oil in a force-feed turbine lubrication system.

The oil is darkened more than oil used in a turbine system, but not as greatly as oil used in gasoline engines.

Very little contamination from the fuel.

Demulsifying properties depreciated.

With engine in poor condition, piston rings loose, or combustion unsatisfactory:

Specific gravity decreased.

Flash and fire points considerably decreased.

Pour point decreased.

Viscosity decreased.

Neutralization number, precipitation number, and per cent of carbon residue increases with period of use.

The oil is darkened.

Considerable contamination from the fuel.

Demulsifying properties considerably depreciated.

In view of the foregoing, a high-work-factor oil should prove more stable and be a better lubricant than a low-work-factor oil for use in Diesel engines. This has proved to be true,

less troubles are experienced in the use of the higher-work-factor oils, and oils which have passed satisfactory endurance tests have also passed satisfactory service tests in Diesel engines.

Work Factor of Aviation Oils

The Navy has completed a remarkably successful year in aviation. It is believed that the lubricating oil used in the aviation engines contributed somewhat to this success. In the beginning, aviation was handicapped by a lack of knowledge of the proper oil to use for lubrication. The motor industry, while much older, offered little assistance of value. Even such a simple matter as the proper viscosity oil to be used required a long time for its solution. The advance in aviation engine design from the low-compression, water-cooled motor to the high-compression, water-cooled motor and then to the high-compression, air-cooled motor added to the complications. Lubricating oils which appeared to give good service in the water-cooled motor were not satisfactory for the air-cooled motor. Why such oils proved to be unsatisfactory no one knew. An oil subjected to the standard laboratory tests did not differentiate sharply between good and poor lubricating oils. A great deal of idle conversation was indulged in about high flash points, low per cents of carbon residue, and so on, but such did not advance the art, and consequently many things happened to motors which were difficult to explain.

Since the endurance test demonstrated its value in examining turbine and Diesel engine oils, it was thought that it might possibly be of value in determining the quality of aviation oils. Aviation oils in service are contaminated with the gasoline fuel, but this contamination does not generally exceed 3 per cent by volume. The gasoline absorbed by the oil reduces slightly the viscosity and fire point, and very markedly the flash point, closed cup, of the oil. The neutralization number of the oil is not greatly increased due to the short period of use, but the precipitation number and per cent of carbon residue very often increase greatly, dependent on the quality of the oil.

The endurance test of the aviation oils and the calculated work factor showed that oils which had at one time been considered satisfactory, but had been discarded on account of general poor performance and fouling of the engine, had work factors from 0.50 to as low as 0.10, and, on the other hand, lubricating oils which gave excellent performance and would run indefinitely in the engine with scarcely a sign of carbon deposits on the top of the pistons had work factors of approximately 0.90. The high work factor could not be explained by consideration of carbon residue content of the oil alone, for some of the oils which had very low work factors showed less carbon residue content in the original oil than some of the oils which had high work factors. In fact, it was impossible, and is still impossible, to differentiate between good and poor aviation oils by means of the ordinary standard tests, but it is possible to do so by determination of their work factors. The work-factor method of qualifying aviation lubricating oils has so accurately demonstrated its value by a great number of practical tests that it is scarcely necessary to subject them to service tests in order to prove their suitability. Any one familiar with the operation of high-compression aviation engines recognizes the necessity of maintaining the pistons and cylinders free of carbon deposits; a very slight amount of carbon deposit on these parts greatly increases the detonating properties of the gasoline. While all are aware of the necessity of using gasoline which will withstand the high compression without detonation, very few take into consideration the fact that the use of a lubricating oil which produces carbon deposits on pistons or cylinders is just as objectionable as the use of an unsuitable gasoline. The necessity for the use of high-work-factor aviation oils will become more apparent with the increased use of aviation engines of higher compression ratio.

Purchase of Oils on Work-Factor Basis

Lubricating oils are purchased by the Navy on the service cost per gallon, using the following formula:

$$\text{Service cost per gallon} = \frac{\text{Cost per gallon}}{\text{Work factor}}$$

the low service cost per gallon being considered the low bid. This method of purchase has many advantages, viz.:

It creates a means to compare quality with price and allows selection of the most economical oil from the consumer's standpoint.

It eliminates the personal element in the decision as to acceptability or non-acceptability of a brand of oil.

It is an incentive to refiners to produce oils of higher quality, with some hope of remuneration for the better quality of oils.

It offers a ready means of evaluating oils, when considering the factors of safety, upkeep and repair of engines, and length of service, the higher-work-factor oils increasing the safety of operation and length of service and decreasing the cost of upkeep and repairs.

Conclusion

The object of lubrication is to substitute liquid friction for solid friction in operating machinery. To do this satisfactorily, it is necessary that the liquid possess low internal friction and be capable of long use with minimum change in its properties. The very nature of mineral oils in being resistant to chemical action makes them valuable for lubrication, but this resistance also makes it difficult to evolve satisfactory tests for their quality. The stability of an oil must then be recognized as of great value, but the stability must be determined in a manner which is in agreement with its application; not at too high temperatures or in highly concentrated oxygen atmosphere, but under pressures, temperatures, and in atmospheres which have some relation to service conditions. The results obtained from lubricating oil in service have been the governing factors from which the work-factor evaluation method has been evolved. The changes which take place in the oil in the endurance test and the actual service obtained from the oil are co-related, and consequently form the basis for the work-factor evaluation method.

Color Standardization Movement Proposed

An important meeting which may lead to the standardization of methods of measuring and specifying color is announced by the Optical Society of America.

The first session, to be held at 10:00 o'clock on Thursday, February 26, at the Museum of Science and Industry, 220 East 42nd Street, New York, will deal with industrial color standards, including reflectance measurements in the paint industry, spectrophotometric measurements in the dyestuffs industry, and color problems in the pulp and paper industry, and in the textile industry. The afternoon program includes principally papers on color measurement and color specification.

On February 27, fundamental principles of color specification will be discussed. The morning session will be held in the Physical Laboratory, Columbia University, at 10:00 A.M. The afternoon session will be in conjunction with the American Physical Society, on biological effects of radiant energy.

At 8:00 P.M. Thursday, February 26, a special conference is being called at the Museum of Science and Industry, at which there is now in progress, and will be until March 15, a special exhibition of the science and art of color. The meeting Thursday evening will consider the organization of an inter-society committee on color specifications and may have important results for all color using and color producing industries.

The conference will discuss questions not of specifications but of organization, and whether joint action by interested technical and trade groups is possible and desirable. Such groups include textiles, ceramics, drugs and chemicals, architecture and building, paints, railways, motion pictures, pulp and paper, art schools and museums, illuminating engineers, and psychologists.

English Manufacturers Sell Standard Electric Stove

A unique standardization project has been completed in England with the design of a standard electric stove which is being manufactured by a number of firms responsible for the production of more than nine-tenths of the electric stoves made in England. This project probably marks one of the most important attempts yet made to stimulate the use of a product by means of standardization.

In this stove, which is called the British Standard Cooker, there is provided, according to the announcements, a simple and reliable appliance of standardized construction to be sold at a relatively low price. An added factor which is expected to help popularize electric cooking with this stove is the ease and low cost of replacing parts. The stove was designed by a joint committee representing the Incorporated Municipal Electrical Association and the British Electrical and Allied Manufacturers Association.

In commenting on this new development, the *Electrical Review* of London states:

> "Combined action by electrical manufacturers comes none too soon to meet the challenge of recent developments in gas cookers, also a result of the pooling of experience. In face of the needs of the situation, the commercial advantages of the British Standard Cooker, in our opinion, easily outweigh the omission of technical points which individual manufacturers may, perhaps rightly, regard as superior in their own specialized designs. . . .
>
> "Whatever may be thought about constructional details, these do not strike us as the most significant aspect of the British Standard Cooker. The main point is that manufacturers of upwards of nine-tenths of the electric cookers made today have sunk quite obvious differences of opinion on what constitutes the ideal technical design and have agreed to the compromise requisite for mass-production of a commercial article."

Some Problems of Standardization in the Printing Industry[1]

by

Fred S. English, *Chief Engineer*
The Babcock Printing Press Mfg. Co.

An outline of standardization problems in connection with the design and use of cylinder printing presses

This paper is of special interest because of the recent affiliation of the United States Government Printing Office with the American Standards Association as a Member-Body. A brief reference to the paper was made in the December, 1930, issue of the ASA BULLETIN.

In considering the general subject for this session, i.e., "The Design of Flat-Bed Cylinder Presses," it appears that there are certain fundamental principles which are dependent upon various established or non-established standards. Undoubtedly these standards will be assumed or taken for granted in the development of the papers for the session. It seems, therefore, that a paper along these lines will be appropriate, considering particularly the lack of uniformity of many of these so-called standards.

Apparently little work has ever been done along the lines of standardization in the printing industry. To be sure, there is a standard height for flat forms, and the industry is approaching a standard thickness for flat plates and bases; there also is something in the way of standard sizes of sheets, and partially standardized catalogue, book, and magazine pages.

The U. S. Bureau of Standards, cooperating with various organizations, has recommended standard sizes for paper, catalogues, commercial forms, checks, etc., but apparently they are not closely followed.

Practically everything else has been left to the varying ideas of the different equipment and material manufacturers or to the users of such equipment and material.

This paper will deal with some of the difficulties which, due to this lack of basic standards, face the manufacturer and user of printing machinery, with the hope it will have a part in the development of much more complete standardization than we have at the present time.

Type Height.—The height of flat forms is already standardized in this country at 0.918 in., and this, of course, applies to both types and plates.

Height of Bed Bearers.—The height of flat-bed bearers, however, is not standardized, some manufacturers apparently considering that they should be exactly type high and others that they should be just a trifle lower.

It is possible that some makes of presses run better with bearers of one height, and others with bearers of another height. Still, it would seem that the pressman would be better off if he always knew the exact relation of the top surface of his type-high form to the top surface of his bearers.

Standardization of bearer height, coupled with standardization of the depth of the impression, which will be considered later, would certainly tend toward more uniform make-ready and more uniform impression.

Height of Bases and Plates.—An inspection of the catalogues issued by the various manufacturers of patent bases discloses the fact that some of these bases are made 0.757 in. high, while others are 0.759 in. high; and, what is possibly more serious, it is not uncommon to make bases to special heights to suit the whims of some particular customer. These special heights vary all the way from 0.688 in. up to 0.759 in. In addition there is still another height for original half-tones. This, it seems, is absolutely necessary.

However, the International Association of Electrotypers is now working toward the standardization of the height of bases and plates. In order to invite discussion, its Standardization Committee has rendered a tentative report recommending the height of bases as 0.759 in., and the corresponding height of plates as 0.154 in. This leaves 0.005 in. for interlay or underlay.

This association feels that scientifically there should be no allowance for interlay, but recognizes that many pressmen demand it, and there-

[1] A paper presented before the Annual Meeting of the American Society of Mechanical Engineers, New York City, December 1 to 5, 1930.

fore allows for it. The fact is recognized also that light work may not require quite as heavy an impression, and therefore a plate thickness of 0.151 in. is recommended for such work.

Much confusion will be saved in the pressroom when this or some other standard is finally adopted and comes into general use, as it certainly will be more convenient for the pressman to know that he will find the same underlay conditions no matter what style of base he is using.

Curved Plates.—When one comes to consider curved plates he finds one of the most unsatisfactory conditions with which the industry has to deal, both as to plate thickness and as to cylinder diameter. The International Association of Electrotypers reported that they found seven different thicknesses of plates and 20 different diameters of cylinders as standards in fairly constant use in *one foundry*. These plate thicknesses varied from 0.152 to 0.375 in., and the cylinder diameters from five to forty-eight in.

The U. S. Bureau of Standards reports that it found one printing establishment in Baltimore which had 26 different curvatures or thickness of plates.

At first glance it would seem that the small-diameter cylinder would require a thicker plate than the large cylinder, on account of the greater tendency to buckle on the small cylinder. However, the evidence submitted by the Electrotypers Association does not prove this to be true, and it is making a tentative recommendation of 0.166 in. as a uniform thickness for all plates.

In this connection consideration also should be given to the depth of the recess in the cylinder for these plates, i.e., how much if any should be allowed for underlay.

Diameters of Cylinders.—Standardizing the diameters of the cylinders on rotary presses presents a much more difficult problem, because the diameter of the cylinder is dependent upon the maximum size of sheet which the press is intended to print.

This is especially true in the case of web presses, where the diameter of the cylinder is absolutely dependent upon the size of the page or group of pages which it is intended to print. Therefore in this case the sizes of magazine pages must first be standardized.

In the case of sheet-fed rotary presses it is true also that the diameter of the cylinder is dependent upon the maximum size of sheet which the press is intended to print, and in general every press manufacturer is striving to get the largest sheet possible on the smallest diameter of cylinder, because the speed as well as the cost of his press is dependent upon the cylinder diameter.

Notwithstanding all this, it would seem that 20 different diameters are more than is necessary and that a series of cylinder diameters could be worked out which would adequately cover all requirements, provided the size of the pages of magazines and mail-order catalogues, as well as flat sheets, were properly standardized.

Even suppose it were found that 20 different cylinder diameters were necessary, is it not possible that standardization of these 20 sizes would prevent the future addition of more odd sizes?

With the thickness of plates and the diameters of cylinders properly standardized, the plate maker would have an opportunity to equip with standard plate-making machinery, which could be used for the requirements of many different customers, instead of being obliged to provide new equipment every time a new size or style of press is brought out, and having such special equipment stand idle except when it is being used for one special customer or group of customers. The cost of plates would undoubtedly be reduced, and at the same time the quality of the plates would be improved.

Depth of Impression.—The depth of the impression surface on impression cylinders, i.e., the distance from the surface of the bearers to the body of the cylinder, is different in different makes of presses. This means a different total thickness of the tympan, and consequently a

B. L. WEHMHOFF

The Technical Director of the United States Government Printing Office who has been appointed by the Printing Office as its representative on the ASA Standards Council. Under Mr. Wehmhoff's direction the Printing Office carries on extensive research and standardization in connection with the purchase and use of equipment and supplies. The purchase of over 50,000,000 pounds of paper during the last fiscal year indicates the magnitude of the problems of control involved.

A. E. Hanson, Superintendent of Construction and Maintenance of the Government Printing Office, has been appointed as Mr. Wehmhoff's alternate on the Standards Council.

varying degree of solidity, so that the pressman who works on different presses must carry these varying conditions in his mind. Possibly this is of minor importance, but certainly standardization would be helpful, and it should not be a difficult thing to achieve.

Height of Cutting and Creasing Rules.—There is no standard height of cutting rule for use on cutting and creasing presses. Two heights are in common use, 0.923 in. and 0.937 in., but there are several other heights in fairly common use, running all the way from 0.916 in. to 1 in.

On account of this lack of standardization, cutting and creasing presses must be flexible, i.e., they must be built so that they can be adjusted readily to accommodate these different heights of rule, and the manufacturers must stock a miscellaneous assortment of bearers.

It would not be difficult for the manufacturers of these presses to build them for a standard height of rule, but it is difficult to persuade the proprietor of a folding-box plant to use any height of rule but that to which he is accustomed.

Creasing rule is not so easily standardized, because the height must vary somewhat with the thickness of the stock being run. Besides, there is another element which enters into this situation, the fact that different pressmen have different ideas as to the best height of creasing rule for any particular thickness and grade of stock.

Possibly these ideas could be standardized, and this, with standardization of the cutting rule, would reduce the number of sizes of creasing rule materially.

Standard Sheets and Forms.—There are certain standard sizes of sheets in fairly common use, but it is not uncommon for a printer with a large contract to order stock especially suited to the job. Why? Simply because the job itself is non-standardized.

To be sure, there have been attempts to standardize catalogues, but the standard sizes do not seem to be followed very generally. This may be because the advertising experts do not fully understand the importance of such standards, but it is more likely due to the fact that a large proportion of printed matter is laid out by non-experts.

If the printer would adopt certain standard sizes of printed matter, both in sheet and form sizes, and then insist that all jobs be made to those sizes before considering them, it would assist very materially not only the paper mills and jobbers but the plate makers and the press manufacturers as well.

For instance, suppose the press manufacturer is designing a new press to take, say, as maximum, a 25 × 38 in. sheet. The first problem he encounters is, How large a form must be printed on that sheet? The present answer is 25 × 38, which all know is almost impossible. Notwithstanding the practical impossibility of doing it, sooner or later some printer is going to take such a job and try to run it on that press. He will get in endless trouble, and probably wind up by running it at a slow, expensive speed and with less than the full number of rolls covering the form.

Suppose it were thoroughly understood that it cannot be done and that no printer would consider the job until it was made to standard size; just imagine how much trouble would be saved for all concerned.

One might go a step further and insist that invoices, bills of lading, bank checks, and a thousand and one other things of that kind should all be in conformity with the U. S. Bureau of Standards recommendations.

Names of Parts.—Except for a few of the larger and more prominent parts, the names which are used in describing the various parts of printing machinery and which must be used by the printer in ordering repairs vary according to the ideas of the manufacturer. To be sure, each different style of machine has some parts unlike those on any other machine, and for these the manufacturer must coin a name, but if the basic units had standard names it would greatly assist the printer in ordering repairs.

For instance: A printer orders a fountain roll. He actually wants the composition roll which transfers the ink from the fountain, but he gets the roll which works inside the fountain proper and delivers the ink to the composition roll in question. Why? Because the manufacturer who received the order calls this roll, which works inside the fountain, a fountain roll; according to that manufacturer's code, the printer really wants a duct roll.

You can readily imagine how the printer goes "up in the air" and the harsh names he calls the manufacturer. Some people call this roll which works inside the fountain a "ball" or "bole" instead of a "roll."

Some manufacturers call the parts on which the bed runs "tracks;" others call them "way frames." We have "feed guides," "side guides," "drop guides," "drop fingers," "lazy fingers," "grasshoppers," etc., without limit and all mixed up. Why not unscramble the mess, make a fresh start, and then try to teach the printer to use the correct names?

Summary.—No attempt has been made in this short paper to cover all the possibilities or to define just what the various standards should be or how the work should be done. It is intended, rather, to show the vital need for more standardization in the printing industry, with the hope that it will help lead the way toward standardization of many units which are now left entirely to the imagination of either the printer or the equipment manufacturer.

Safety Engineers Study Low Voltage Hazards

A study of low voltage hazards of interest in connection with the National Electrical Code has been made by the American Society of Safety Engineers. The Society found, according to a report on the study in the *Electrical Installation Record* for December, 1930, that 44, or more than two-fifths of the 106 fatal cases studied, were caused by contact with ordinary 110 a-c voltage.

"There were 58 industrial fatalities, nine mine, and four railroad fatalities. Home fatalities ranked second to industry with 31. Bathtub fatalities led the domestic list with 12. Next in importance came fatalities from contact while on wet basements or earth, with seven fatalities.

"In gathering information for the study, the National Electric Light Association found that 45 of the 106 cases studied involved use of defective materials, and there were six flagrant violations of the National Electrical Code. At least one-third of the fatalities may be attributed to defective materials, such as lamp cords not properly maintained. Five to 12 per cent were due to installations not in accordance with the standard practices as represented by the Code.

"The report emphasized the necessity of using proper types of extension cords, careful maintenance of such cords and of all electrical equipment, the use of weather-proof sockets, proper grounding of portable devices, especially in damp locations."

Requirements for Construction of Clay Hollow Tile Published

The Eastern Manufacturers' Group of the Structural Clay Tile Association has just published "Recommended Minimum Requirements for Structural Clay Hollow Tile Construction." The specifications included in the book are the result of exhaustive research carried on by the Bureau of Standards and by the Research Department of the Structural Clay Tile Association.

The book is divided into three main sections: one section on definitions, one giving the recommended minimum requirements, and one devoted to reprints of the latest standard specifications governing manufacture and tests for clay hollow tile issued by the American Society for Testing Materials.

Members interested may borrow a copy of the book from the ASA Information Service.

Research Department Organized by Gray Iron Institute

Sustaining-Members of the American Standards Association may be interested in the service offered by the newly-established Technical and Research Department of the Gray Iron Institute. The Institute advises that the new department is organized:

"for the purpose of advising buyers and users of castings in regard to specifications and selection of the correct grade of material for any specific purpose and to secure the very best results from gray cast iron in its many forms. Such problems as the proper mixture to use for a given condition, suggested methods for producing castings; in fact, engineering or manufacturing problems of any kind pertaining to gray iron are being handled by this department."

Committee on Procedure

Appointments to the ASA Committee on Procedure for the year 1931 were announced at the annual meeting of the American Standards Association on December 11. J. C. Parker, vice-president of engineering, Brooklyn Edison Company, becomes chairman of the committee. The other members are:

Alexander Maxwell, National Electric Light Association, New York City

S. L. Nicholson, Westinghouse Electric and Manufacturing Company, New York City

Rear Admiral G. H. Rock, assistant chief, Bureau of Construction and Repair, Washington, D. C.

A. W. Whitney, associate general manager, National Bureau of Casualty and Surety Underwriters, New York City

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Correction—Zinc Coating G8c-1930

On page 30 of the January, 1931, issue of the ASA BULLETIN it was incorrectly stated that American Tentative Standard G8c-1930, Zinc Coatings on Structural Steel Shapes, Plates, and Their Products, was submitted to ASA for approval under the proprietary sponsorship method. This standard was prepared under the sectional committee procedure. It was approved by the sectional committee in charge of the project, under the chairmanship of J. A. Capp, General Electric Company, Schenectady, N. Y., and submitted to ASA by the American Society for Testing Materials, sponsor of the committee.

Procedure for Inspection of Materials Recommended in New Pamphlet

The National Engineering Inspection Association, the organization of which was announced in the August, 1930, issue of the ASA BULLETIN, has published a pamphlet on tentative methods of procedure for inspection of materials. The study of inspection methods and techniques and the standardization of procedures for inspections of various types of materials and products is an important step toward the achieving of a maximum of usefulness from standards and specifications. The present pamphlet is published for the purpose of inviting suggestions and the methods presented are, therefore, subject to revision. Inspection procedures for the following products are included in the pamphlet:

Structural steel for buildings and bridges
Tee and girder rails and accessories
Steel plate pipe
Hot rolled or drawn steel and iron pipe
Boiler and firebox steel
Cast iron pipe and specials
Cement
Concrete
Timber, piles, poles, and ties

In the case of structural steel for buildings and bridges, there are specifications for mill inspection, shop inspection, and field inspection.

Copies of the pamphlet may be obtained from Watson Vredenburgh, president of the National Engineering Inspection Association, 122 Greenwich Street, New York City, or a copy may be borrowed from the ASA Information Service.

A typical method of inspection, "Tentative Method of Procedure for Inspection of Hot Rolled or Drawn Steel and Iron Pipe" is reprinted herewith:

Tentative Method of Procedure for Inspection of Hot Rolled or Drawn Steel and Iron Pipe

Preliminary: (a) Upon receipt of order, inspector shall communicate with manufacturer, verify record of order, general details and specifications of same, together with requirement of inspection. Arrangement shall be made to obtain required notice for attendance of inspector or for his attention, if he is in daily attendance at mill.

(b) Inspector shall check his orders against the mill orders to assure that no variations exist. Should any difference be found, inspector should at once communicate with his headquarters for necessary instructions before proceeding with inspection.

Tests: Inspector shall witness tensile, bend, crushing, flattening, flanging, and other tests as specified. Analyses shall be obtained from manufacturer and all results checked and verified against the specifications. When independent check tests or analyses are to be made, samples or drillings shall be taken in the presence of inspector.

Inspection: (a) Dimensions: The inspector shall check each pipe for length, diameter, roundness, and wall thickness. Beveled pipe shall be checked for proper degree of bevel with specified thickness at edge. Victaulic grooves shall be checked for width, location, and diameter of pipe at base of groove.

(b) Surface: The inspector shall examine each pipe for straightness and eccentricity, and both inside and outside surfaces for visible defects and soundness. He shall examine the entire length of weld on all welded pipe.

(c) Couplings: The inspector shall check all mill size plugs and couplings. The inspector shall check and examine for defects 10 per cent of couplings for length, size of thread, weight, and recess. The inspector shall examine the weld on each coupling.

(d) Threads: The inspector shall check all threaded pipe on field end for size by use of check size coupling. All pipe shall be checked on mill end by stand-off of applied coupling, after hand pull. The mill end of threaded pipe shall be examined for all defects previous to coupling application. The use of proper thread compounds shall be verified.

(e) Pressure Tests: The inspector shall witness all pressure tests as specified.

(f) Coating: The inspector shall examine the coating and thread protectors and shall verify the use of material specified and its proper application.

(g) Weight: The inspector shall verify the specification requirements as to weight.

Marking and Loading: (a) The inspector shall verify that the marks are in accordance with the order and specifications and are legible. All accepted pieces shall be marked with inspector's mark, except in the case of bundled pipe when metal tags shall be marked.

(b) Loading into clean cars shall be investi-

gated as a safeguard against damage during transportation.

Reports: Reports shall be made promptly after shipment, or as directed, exhibiting carefully and concisely the tests and analyses results and the actual conditions of manufacture.

Centralized State Purchasing Urged by Maine Investigators

The difficulty of persuading the purchasing agents of state institutions to relinquish the privilege of personal selection and to use approved standards and specifications instead has led to a recommendation for the establishment of a Bureau of Purchases in the State of Maine. The recommendation is made in a report "State Administrative Consolidation in Maine" conducted for Governor W. T. Gardiner by the National Institute of Public Administration, New York City. The report points out that individual institutions prize their purchasing prerogatives too highly to release them voluntarily. The employees of the institutions insist upon making their own choice of a variety of brands.

The State of Maine Purchasing Association was formed by the stewards of state hospitals to permit the cooperative purchase of staple requirements. The Association now includes representatives of all state institutions and of several state departments. The majority of the institutions do not, however, use the Association's purchasing facilities.

"The problem of standardization has proved the big stumbling block for the Association," says the report. "At its monthly meetings, the Association's members discuss standards and adopt them by majority vote. Standards have been adopted in this way for seventy commodities, principally foodstuffs, but including gasoline and automobile tires and tubes, which are now being purchased by the state highway commission for all members of the Association but since the Purchasing Agents' Association has no legal status, it cannot enforce the use of the standards adopted by majority vote. Many of the institutions whose representatives vote for the adoption of a certain standard, refuse to use it. Standards for bed sheets and pillow cases were adopted last year after very considerable effort, but thus far it has been impossible to secure agreement on the use of such standards by the tuberculosis sanatoria, for example, which have uniform populations and common requirements.

"Since the institutions will not cooperate voluntarily, coercive measures must be adopted. It is therefore recommended that a bureau of purchases be established in the department of finance. To this bureau should be given the power to control the purchases of the state institutions and departments, under the supervision of the advisory committee discussed below. . . .

"Since the commission would not have time to perform the routine work of standardization, the State of Maine Purchasing Agents' Association should continue to meet regularly for purposes of standardization and for discussion of material problems. It is contemplated that the standardization commission would approve the standards which the Association adopts by majority vote. But the commission should compel the members of the Association to formulate standards for all classes of commodities which it has thus far ignored; and the commission should enter the picture only to ratify action by the Association, to force action where inaction now prevails, and to decide disputes where agreement is found impossible. The Association and the standardization commission should call upon the engineers, chemists, and other technicians in the state service for aid in formulating standards and written specifications.

New Member of Committee on Small Tools

The appointment of a new member of the sectional committee on Small Tools and Machine Tool Elements (B5) has been announced by the American Society of Mechanical Engineers. David W. Ovaitt, efficiency engineer, Buick Motor Company, Flint, Michigan, has been assigned to the sub-committee on punch and die holders of this sectional committee. C. E. Rundorff, research engineer, Buick Motor Company, Flint, Michigan, is his alternate.

American Institute of Architects on Sectional Committee

The American Institute of Architects has accepted the invitation tendered by the American Standards Association to become a member of the sectional committee in charge of the project, Safety Code for Grandstands (Z20). LeRoy E. Kern, technical secretary of the Institute, has been appointed to act as representative of the Institute on the committee.

Standards Unify Marketing of Merged Companies

The use of standards to aid in the organization of a unified marketing system for a group of merged companies is described by Adrian D. Joyce, president of the Glidden Company of Cleveland, in the December, 1930, issue of *Executive Service Bulletin*, published by the Policyholders Service Bureau, Metropolitan Life Insurance Company. The Glidden Company, which originally manufactured varnishes, found that because of its limited line its selling costs were too high. They tried to solve this problem by acquiring several paint companies.

"Each of the combining companies," says Mr. Joyce, "had its own well-developed private brands which were well known and well established in their particular localities. To some extent, certain of these companies were operating in overlapping territories and were competitive. The first step in working out the merger, then, was to establish a central laboratory to determine the best products in each line and class. These products were definitely fixed as the standards of quality for the organization as a whole and all products in the same group gradually were made to conform to these quality standards. The original trade names and brands were continued.

"The next step was to develop standard formulas so that all products of a comparable group would be identical in composition, although marketed under a variety of trade names or brands. With standardized operations it was possible to produce the identical product in any or all of the various plants and to secure the benefit of the established brand names in each territory through the simple expedient of labeling. The company was then in a position to place the distribution of its products on a strictly sectional basis.

"To illustrate, the Campbell Paint and Varnish Company of St. Louis was designated to supply the Mississippi Valley and the Southwest. As an independent organization, this company had sold its special brands to an important customer in Chicago. Subsequent to the merger, an identical product was being produced by the Heath and Milligan Manufacturing Company of Chicago. Under the new distributing plan, the Chicago customer was supplied from the Heath and Milligan plant with the same product, labeled with the Campbell brand, that he had been receiving previously."

Textile Journals Favor Standards as Aid in Purchasing

An interesting development, occasionally noted in connection with proposals for standardization as an aid to purchasing, is the belief that standardization is unnecessary, and that the personal judgment of an individual is alone indispensable (and sufficient) in making selections or appraisals of goods. The reaction of informed persons to this view is seen in the following, quoted from the *Daily News Record* and *Womens' Wear*, both New York Textile Trade publications.

"Some retail store buyers have more or less resented the plan for branding of standardized goods, stating that they are capable of judging the good from the poor rayon merchandise and there also seems to be an objection to the fact that anybody is telling them anything about fabrics or garments.

"This situation seems to be particularly true in respect to the buyers of piece goods. In regard to rayon, past performances have shown that with many buyers this pride in being able to pick the good from the poor rayons was misplaced and in many instances buyers have loaded the departments with goods that brought pecks of trouble to the store.

"One store executive in having the objection of the buyers placed before them said, 'It is just too bad that they object, but we have had entirely too many complaints from poor merchandise of rayon yarns and we are inclined to grasp at any straw that will tend to give us some assurance that the flood of claims that we have experienced, particularly on dresses of rayon flat crepe, will be reduced.'

"An executive of one retail group said that to have any degree of support in the merchandising plan of standardizing rayon fabrics, that it would be necessary to address the promotion of such a plan to the store executives and store adjustment managers and let them bring pressure to bear."

Wood Poles Standard Used in Wisconsin

The American Standard for ultimate fiber stresses for wood poles O5a-1930 has been incorporated in the new Wisconsin Electrical Safety Code, according to a note received from C. B. Hayden, engineer of the Railway and Utilities Division of the Railroad Commission of Wisconsin.

Textile Industry Uses Standards in Marketing Products

The injury done to the marketing of the product of an entire industry by the debasement of quality of the product has been commented upon in previous issues of the ASA BULLETIN. Many industries have attempted to combat the effect of such debasement by the establishment of quality standards which have been made the basis of advertising and merchandising campaigns. Far-reaching debasement of quality has been especially common in the textile field and, according to the *Boston Evening Transcript*, the rayon industry is now feeling its effects. The following quotations, the first from the *Boston Evening Transcript* relating to the rayon industry, and the second from the *Proceedings of the National Association of Furniture Manufacturers*, indicate the effects of quality debasement upon industry.

"Nineteen hundred and thirty witnessed the first serious setback the rapidly growing rayon industry ever encountered," says the *Transcript*. "Preliminary production estimates indicate a falling off in volume of output for the first time since synthetic fibers became a large part of the textile industry.

"Competition from over-production affected this new division of the industry as it affected others hundreds of years older. Prices declined, merchandising faltered, and at the end of the year conferences of all producers were being encouraged for the purpose of bringing order out of chaos. Labor troubles in a Tennessee plant were of a serious character and halted production for a long time.

"The most striking merchandising policy adopted was that of the Viscose Company, the largest producer. After having adopted a brand for first quality output it entered on relations with weavers, knitters, and others whereby the branded product was made known through to the consumer, and the quality of the output, whether in knit or woven goods, remains guaranteed from the testing rooms of the fiber manufacturer right through every test applicable in various processes down to the user.

"This was made necessary by the constant debasement of rayon products by careless or designing manufacturers after they had been passed as first quality from the spinning mills."

The following quotation is from an an address "What's Ahead Tomorrow in Home Furnishings" by Chairman Haake, managing director of the National Association of Furniture Manufacturers, as reported in the *Proceedings* of the Eleventh Annual Convention of the Association held in September, 1930:

"Take, for example, mohair upholstered furniture—mohair is one of the most respectable of coverings for upholstered furniture. It has more life in it. It looks better for a longer time; it is an aristocrat among the durable covers. Yet today a mohair that sold some time ago for $2.40 can be bought for $1.90. If another furniture manufacturer wants to beat the $1.90 he goes after $1.80 and down to $1.60. Then they begin to thin out the pile and substitute ordinary wool for goat's hair or taking cheaper cuts of the hair from different portions of the goat's body, until there is danger now of driving mohair out as a fabric. It was driven out once before. It is believed by some people that certain manufacturers who don't want to make mohair are deliberately encouraging this lowering of price so that mohair as a competitive fabric may be driven out.

"Take the inner spring mattress which has had a terrific battle to get itself established and finally has been thoroughly established—$39.50 is a more or less standard price. We found for a while that Macy's, for example, had it down to $35.00. Someone else had to beat that a little bit and came down to $29.50. Then the concern that put the $39.50 mattress over recognzied the situation and came out with one that now sells for $23.50. The first ones they built didn't stand up very well and they had to take back a lot of them. From $39.50 as a beginning you can go to Chicago today and buy an inner construction mattress for less than $10. It has come to the point where the price is so low that if the trend persists there is serious danger of that particular article being destroyed as a source of profit for the retailer as well as for the manufacturer. . . . There is distinct need for counteracting this lowering of prices and lowering of quality which go hand in hand. . . ."

Technical Progress More Rapid in Standardized Industries

An unfortunate tendency to confuse the term "standardization" with the sense of permanence or resistance to change is found in an article by J. B. Rathbun which appeared in the November, 1929, issue of the *Petroleum Age*, and is reviewed in the *London Petroleum Times*. Referring to the fact that the problems with automobile motor fuel are fundamental problems arising from the fixity of the general design of automobile engines, the review says:

> "Hence the problem is not one to be undertaken by the refiner, but belongs to the builder of the automobile engine. Mr. Rathbun blames standardization, which took place early in the life of the automobile industry, and the service organizations established by the manufacturers with their educational campaigns, which have prejudiced the public against any other form of locomotion than the present. Manufacturers are hostile to any suggestion of change of engine type. 'Standardization, which is always disastrous to any new industry in the way of development and improvements, has conferred upon us the four-stroke poppet valve engine, a type that is so destitute of starting torque that it must be cranked before it will run at all.' This type of engine lends itself to mass production, and in spite of its many shortcomings in the way of performance and fuel economy, 'the public, having been educated to the four-stroke cycle engine, will probably stay educated; it is too expensive and troublesome to institute radical changes.'"

The standardization activities and program of the automotive engineers are not in the remotest sense responsible for the type of fixation referred to by Mr. Rathbun. The type of standardization actually carried out in this industry is one of details and not of design, and the constant flow and quick adaptation of new inventions in automotive manufacturing practice is a sufficient indication, if any be needed, that the stability of automobile engine design, if in fact it exists in the sense referred to by the writer mentioned, represents not conscious standardization but simply lack of any known better way of fulfilling satisfactorily all of the functions of the engine.

Those familiar with the actual working out of planned standardization programs in industry will at once see the fallacy of the reasoning shown in the quotation above. In fact, those industries where standardization is most effective and most broadly applied—as, for example, the telephone, electrical machinery, lamps, meat packing—tend to be the ones wherein the pace of technical progress is most rapid, and other industries—such as small tools and many common kinds of hardware, many important foodstuffs, typewriters, cotton, silk and woolen textiles and garments of all sorts, footwear, and kitchenware—which have shown a practically continuous stability of production methods and products over a period of decades, are noteworthy for their lack of coordinated standardization programs, in many instances for their complete indifference to the possibilities of standardization, even of so simple a character as an agreed method of measurement and scale of sizes where such would obviously be capable of effecting notable economies in production and marketing.

F. J. S.

New Edition of Cable Specifications Issued by A.E.I.C.

The fourth edition of the Association of Edison Illuminating Companies' "Specifications for Impregnated Paper Insulated, Lead Covered Cable," dated July, 1930, is now available.

The introduction states that the specifications are intended to apply to all sizes and classes of impregnated paper insulated, lead covered cable which is to be used for the underground transmission and distribution of electrical energy in underground conduit systems excluding cable for pressure measurements, fire alarm signaling, telephone, and similar services, and that the purpose of the specifications is to insure the furnishing of cable of high quality, manufactured in accordance with the best accepted practice which will operate successfully at the rated voltages given in the specifications.

The specifications are divided into the following headings: introduction, general requirements, routine factory tests, tests to be made on samples, tests to be made after installation, reels and shipment and miscellaneous.

Copies of the specifications are available for loan through the ASA Information Service.

American Society for Testing Materials Publishes Books of Standards

The American Society for Testing Materials has just issued its Book of A.S.T.M. Standards, a triennial publication containing all specifications, methods of test, and definitions fully approved and adopted, and the 1930 Book of A.S.T.M. Tentative Standards, an annual publication, containing those specifications, methods of testing, and so forth, having a tentative status. Copies of these publications may be obtained from the ASA Information Service, A.S.T.M., 1315 Spruce Street, Philadelphia.

The Book of A.S.T.M. Standards is published in two parts—Part I on Metals (1000 pages), containing the standards relating to metallic materials, and Part II on Non-Metals (1214 pages), containing standards covering non-metallic materials.

Part I—Metallic Materials

Of the 179 standards on metals published in Part I, 105 cover the ferrous metals—steel, cast iron, wrought iron, alloy steel, and ferro-alloys; 67 relate to the non-ferrous metals—nickel, copper, aluminum, etc., and many alloys; while 7 are of general interest.

The standards in Part I, assembled in a sequence determined by the specific materials or products to which they apply, cover steel rails and accessories; wheels and tires; structural and boiler steels; steel for welding; concrete reinforcement steel; bar steels; spring steel and springs; steel castings, chain forgings, and axles; steel tubes and pipe; tool steel; steel for high-temperature service; zinc coated wire and wire products; wrought-iron bars, castings, plates and pipe; pig iron; cast iron and finished castings; malleable castings; and ferro alloys. The specifications in the non-ferrous group cover ingot copper, zinc, lead, nickel, aluminum and aluminum alloys, copper wire and cable, brasses and bronzes, solder metal, white metal bearing alloys, copper and brass plates and tubes. Methods are also included for Brinell hardness tests, metallographic testing, preparation of micrographs for metals and alloys, and a recommended practice for radiographic testing of metal castings. Definitions of terms relating to wrought iron, to methods of testing, to metallography, and to specific gravity are also included. New standard specifications have been adopted this year for steel tie plates, iron and steel chain, gray-iron castings for valves, seamless copper tubing, bronze and hard-drawn copper trolley wire, several specifications for galvanized wire and wire products and specifications for zinc (hot-galvanized) coatings on structural steel shapes and plates. Included in addition to these specifications are new standard methods of sampling rolled and forged steel products for check analysis and test methods for galvanized wire and wire products, and a test for change of resistance with temperature of electrical heating materials. Standard specifications for open-hearth steel rails, concrete reinforcement bars, steel pipe and boiler tubes, hot-rolled bar steels and cold-finished shafting, malleable castings and wrought iron bars, plates and pipe that were revised during the year have also been included.

Part II—Non-Metallic Materials

The 251 standards in Part II cover the following miscellaneous groups of non-metallic materials and products: cement, lime, gypsum, concrete and concrete aggregates, brick and refractories, pipe and drain tile, hollow building tile, paints, pigments, shellacs, varnishes, petroleum products and lubricants, bituminuous and non-bituminous road materials, coal and coke, timber and timber preservatives, waterproofing and roofing materials, insulating materials and rubber products, textile materials, and thermometers for general use. Included in this volume are new standards adopted this year comprising specifications for paving and building brick; sand-lime brick; wall, floor and partition hollow clay tile; Keene's cement and gypsum plasters; gravel for bituminous concrete; several specifications for tar cements for road application; tolerances for tire cord fabrics, and fabrics other than cord fabrics; methods of testing concrete aggregates; gypsum and gypsum products; analysis for color of paints; tests for sulfur in gasoline, melting point of petrolatum, autogenous ignition temperatures of petroleum products; mechanical analysis of coal; and test methods for electrical porcelain. The specifications for Portland cement revised to include higher tensile strength requirements and the methods of testing cement changed by the inclusion of tolerances on weights and dimensions of apparatus are also included. Of particular interest are the revised standard specifications for structural wood, joist and planks, beams and stringers, posts and timbers.

The Book of Standards may be obtained in cloth binding at $7.50 for each part when purchased separately, or at $14.00 for both parts.

1930 Book of Tentative Standards

The Book of A.S.T.M. Tentative Standards (864 pages), an annual publication, contains 155 tentative specifications, methods of test, definitions of terms, and recommended practices, 28 relating to metals and 127 to non-metallic materials and products. The tentative standards are issued for one or more years with a view to obtaining criticisms. Although in the trial stage of A.S.T.M. procedure, they represent the latest thoughts of the committees on the subjects covered and are therefore being applied in the various industries. Many of the tentative standards are frequently used in conjunction with the A.S.T.M. standards.

Included in this volume are 21 new tentative standards developed this year. In the metals group are new specifications for austenitic manganese-steel castings; open-hearth iron plates; aluminum alloy (duralumin) sheet; aluminum-manganese alloy sheet; magnesium-base alloy castings; aluminum base alloy castings and ingots; copper-base alloys in ingot form; and a method of test for thermoelectric power. A specification for high-early-strength Portland cement is an important contribution to the construction field, as are also new specifications for reinforced-concrete pipe, reinforced-concrete culvert pipe, gypsum sheathing board, timber piles, and glazier's putty; test methods for natural building stone; and a flexure test for concrete. Of interest in the automotive field is the test for dilution of crank-case oil and a test for vapor pressure of natural gasoline. A test method is also included for comparing the thermal conductivities of solid electrical insulating materials. New tentative specifications have also been developed for several lacquer solvents and diluents, namely, amyl acetate, amyl alcohol, butyl propionate, and ethyl lactate. Revisions were also made in 25 of the tentative standards developed in former years in order to keep them abreast of current practice.

Copies of the Book of Tentative Standards may be obtained at $8.00 in cloth binding.

Index to Standards and Tentative Standards

An index (110 pages) of all A.S.T.M. Standards and Tentative Standards has been prepared and is being distributed without charge. The index is a compilation, under appropriate key word subjects covered by the standards, of titles of all standards, together with volume references to the publications in which they appear, namely, Parts I and II of the 1930 Book of A.S.T.M. Standards, and 1930 Book of A.S.T.M. Tentative Standards, and the annual *Proceedings*. The Index is designed to be of service to those familiar with the Society's standards in locating specifications, methods of test, or definitions in the bound publications in which they appear, and as well, to those interested in ascertaining if the Society has issued any standards on a specific subject. The index will be found of great assistance in locating desired references.

A.S.T.M. Committee Reports and Technical Papers

Two new volumes of *Proceedings of the American Society for Testing Materials, 1930*, have just been published, and are available for loan through the ASA Information Service, or for purchase at $6.50 each.

The first volume, Part I, contains the reports of committees working on projects dealing with the following subjects: ferrous metals; non-ferrous metals; cement, gypsum, concrete, and clay products; and miscellaneous materials—preservative coatings, etc. The last part of this volume is devoted to the publication, for the purpose of obtaining comment and criticism, of tentative standards submitted or revised by the A.S.T.M. in 1930; and to the publication of tentative revisions of approved A.S.T.M. standards. The tentative standards and tentative revisions are listed under the subject headings already mentioned in connection with committee reports.

Part II, the second volume of the *Proceedings*, consists of a collection of papers, lectures, and discussions prepared under the auspices of the American Society for Testing Materials. Subject headings, under which the papers are grouped, are as follows: Edgar Marburg Lecture: Color and its Measurement; Symposium on Aircraft Materials: Metals; Symposium on Rosin; Paint; and Rubber.

Bulletin on Paint Available

A description of the properties of aluminum paint is contained in *Research Bulletin Number 10*, published by the Producers' Council, Incorporated, 19 West 44 Street, New York. The *Bulletin* refers to specifications on this subject prepared by the Aluminum Company of America. Specifications of the National Lead Company for painting iron and steel with red lead are reproduced in another document from the same source.

ASA PROJECTS

A Review of Mechanical Engineering Projects under ASA Procedure

The fourth of a series of reviews of standardization projects under the procedure of the American Standards Association

The status of all mechanical engineering projects developed or in course of development under ASA procedure is summarized in the following review prepared by F. J. Schlink, Assistant Secretary, and John Gaillard, Mechanical Engineer, of the ASA staff. The data presented are taken from the files of the American Standards Association and are corrected to February 1, 1931. The personnels of the sectional committees handling the projects may be found by reference to the project section (B) of the 1930 American Standards Year Book (pages 39–52).

B1—Standardization and Unification of Screw Threads

Scope—Nomenclature of screw threads; form of threads; diameters and pitches of screws for various uses; classification of thread fits; tolerances and allowances for threaded parts; the gaging of threads; but not including threads for fire-hose couplings.

Chairman—Ralph E. Flanders, Jones & Lamson Machine Company, Springfield, Vt.

Vice-Chairman—Frank O. Wells, Wells Manufacturing Company, Greenfield, Mass.

Secretary—Earle Buckingham, Massachusetts Institute of Technology, Cambridge, Mass.

The original sectional committee organized in 1920 developed the American Standard B1a-1924 on Screw Threads for Bolts, Machine Screws, Nuts and Commercially Tapped Holes. This was based on the 1921 report of the National Screw Thread Commission, with certain changes suggested by the sectional committee which were accepted by the N.S.T.C. and incorporated in its 1924 report. In 1929, the N.S.T.C. published a new report (dated 1928) making recommendations which were in some respects at variance with those contained in the 1924 report and therefore with the American Standard. The sectional committee was reorganized in May, 1929, to study the new N.S.T.C. report, to survey present practice, and to consider whether the American Standard B1a-1924 needed revision or supplementing. The new committee comprises seven sub-committees, as follows: 1. Scope, Arrangement and Editing of American National Standards; 2. Terminology and Thread Specifications, except Gages; 3. Special Threads and Twelve Pitch Series, except Gages; 4. Acme and Other Similar Threads; 5. Screw Thread Gages and Inspection; 6. Lag Screws; 7. Survey of Present Practice. No definite proposals have as yet been developed by the committee.

B2—Pipe Thread

Scope—Dimensions of the elements of the American (Briggs) standard taper and straight pipe thread, plumbers' threads, threads for rigid electrical conduit and threads for thin tubes; formulas for calculating the dimensions of the threads; gage and working tolerances; methods of gaging the threads.

Chairman—Edwin M. Herr, Westinghouse Electric & Manufacturing Company, New York, N. Y.

The sectional committee was reorganized in 1927 to consider the revision or supplementing of the American Standard B2-1919 on Pipe Thread. The new committee comprises six sub-committees as follows: 1. Editing and Gaging; 2. Taper Pipe Threads; 3. Straight Pipe Threads; 4. Plumbers' Threads; 5. Screw Threads for Rigid Electrical Conduit; 6. Special Threads for Thin Tubes. No definite proposals have been developed as yet.

B3—Ball and Roller Bearings

Scope—Boundary dimensions of ball and roller bearings for radial and thrust loads or combinations thereof, as affecting the interchange or replacement of such bearings in machinery; and the tolerances on such dimensions.

Chairman—F. W. Gurney, Marlin Rockwell Corporation, Jamestown, N. Y.

Vice-Chairman—W. P. Kennedy, Kennedy Engineering Company, New York City.

Secretary—R. S. Burnett, Society of Automotive Engineers, New York, N. Y.

An American Standard on Single-Row Type Annular Ball Bearings and an American Recommended Practice for Wide Type Annular Ball Bearings were approved in April, 1930, and published together in one pamphlet with the designation B3-1930. Whether standard types of thrust bearings should be developed is now under consideration.

B4—Allowances and Tolerances for Cylindrical Parts and Limit Gages

Scope—Nomenclature and classification of fits between cylindrical parts, including allowances and tolerances for interchangeable manufacture; classification and fixing of standard tolerances for plain limit gages.

Chairman—Edward J. Kearney, Kearney-Trecker Corporation, West Allis, Wis.

Secretary—C. E. Rundorff, Research Engineer, Buick Motor Company, Flint, Mich.

The sectional committee was reorganized in the fall of 1930 with the purpose of reviewing the American Tentative Standard B4a-1925 on Tolerances, Allowances and Gages for Metal Fits to determine whether it needs revision or supplementing, in view of progress in the art made since the standard was approved in 1925.

B5—Small Tools and Machine Tool Elements

Chairman—C. W. Spicer, Spicer Manufacturing Company, Toledo, Ohio.

Secretary—J. A. Anglada, President, Anglada Motor Car Corporation, New York, N. Y.

This sectional committee, under the joint sponsorship of the American Society of Mechanical Engineers, the National Machine Tool Builders' Association, and the Society of Automotive Engineers, is composed of 18 representatives from the sponsor organizations, and acts in in an advisory and executive capacity for the several technical committees developing standards under its scope. To date, the following standards developed under its general direction have been approved as American Standards and American Tentative Standards:

	Approved
T-Slots, Their Bolts, Nuts, Tongues and Cutters	1927
Tool Holder Shanks and Tool Post Openings	1929
Milling Cutters	1930
Cut and Ground Thread Taps	1930

In the development of the American Standard for Milling Cutters, the committee was unable to complete the sections on inserted tooth milling cutters and hobs. These subjects are now being considered and upon completion will form a supplement to the standard already issued. The committee on Cut and Ground Thread Taps has continued its activity and is now developing standard dimensions for cut thread straight and taper pipe thread taps; straight shank tapper taps in machine screw sizes; cut and ground thread bent shank tapper taps; and ground thread pulley taps.

The committee on Machine Tapers is investigating the possibility of decreasing the length of shanks of large size tapers and is formulating dimensions for tangs, tang slots, driving keys, inspection gages, etc.

The committee on Spindle Noses and Collets for Machine Tools has considered for standardization various types of spindle ends for lathes, turret lathes, automatic screw machines, and automatic lathes which have been suggested. The most promising of these have been completely designed and are now being tested.

The committee on Designations of Working Ranges, although partially organized for some time, has been inactive, due to an apparent lack of interest on the part of the machine tool manufacturers.

The committee on Twist Drill Sizes has developed a proposed standard series of drill sizes which as proposal "C" is now being studied by various drill users.

The committee on Drill Bushings has tentatively agreed upon nomenclature and constructional dimensions for headless and headed press fit bushings, liner bushings, knurled head slip renewable bushings, and plain renewable bushings.

The committee on Punch and Die Holders has circulated to industry a questionnaire to determine the various types, methods of construction, and materials favored in the several branches of industry. At its December, 1930, meeting, the results of this questionnaire were discussed and arrangements made for the development of drafts showing standard dimensions for the favored types.

The proposed standardization of Circular Forming Tools and Holders has not progressed beyond the preliminary stages of development, because of an apparent lack of interest in the project. At a recent meeting of the sectional committee it was understood that at least one large user group had become interested in the subject and the sectional committee decided to continue the project pending further investigation.

The committee on Chucks and Chuck Jaws has cooperated with the committee on Spindle Noses and Collets and in April, 1930, issued a joint tentative report giving proposed standard dimensions for spindle noses and chucks, and including a series of standard dimensions for scroll and air chucks, air cylinders, air cylinder adapters, and gages. Two hundred copies of this proposal were distributed to representative groups in the machine tool industry for review and criticism.

However, at the meeting of the committee on October 20, the user groups expressed a decided interest in the subject and it was recommended that action be taken to carry this work through to a satisfactory conclusion. In reviewing the project, several engineers expressed a preference

for a spindle nose of the clamp ring type instead of the form proposed.

This caused some delay in the further development of this portion of the proposal and caused the committee on Chucks and Chuck Jaws to proceed with the development of their section as a separate report. With several slight modifications, a series of chuck sizes and general dimensions for air cylinders and adapters together with general dimensions for master chuck jaws and dimensions for an additional line of chucks with master jaws below the face of the chuck, and provided with T-slots, were tentatively established. Copies of these proposals are now being prepared for general distribution to all concerned, for review and criticism.

A committee on Splines and Splined Shafts was organized during the year and working committees were appointed to develop standard dimensions for splines as applied to machine tools and splines as applied to automotive uses. It is also planned to cover other requirements for spline application later, if it becomes apparent that the then available standards are inadequate.

The committee on Electric Welding Dies and Electrode Holders, which was organized in June, 1930, plans to standardize tips and holders for electric resistance spot welding machines; dies and patterns for flash welding and butt welding machines; dies for projection welding machines; wheel and spline electrodes for seam welding machines and electrodes for cross wire welding machines.

A questionnaire to elicit information regarding the nomenclature and dimensions of the various elements entering into their construction has been circulated to industry and the replies received are being used in the further development of the program.

The standardization of Milling Machine Tables was undertaken by the committee in March, 1930. A preliminary investigation of the subject appeared to indicate that it would be a comparatively easy matter to standardize on T-slot spacings but that more difficulty was to be expected in standardizing the widths of tables, particularly in those cases where the mechanisms underneath the tables were affected. Suitable sub-groups are now engaged in preparing detailed proposals on these subjects.

B6—Standardization of Gears

Scope—Standardization of spur, helical, herring-bone, bevel and worm gearing, covering general gear proportions; tooth form; mounting of gears; selection of materials; inspection of gears; nomenclature.

Chairman—B. F. Waterman, Brown and Sharpe Manufacturing Company, Providence, R. I.

Secretary—C. B. LePage, American Society of Mechanical Engineers, New York City.

This committee, under the joint sponsorship of the American Gear Manufacturers Association and the American Society of Mechanical Engineers, was organized in 1921. Prior to that time a considerable amount of work in the field had been done by the American Gear Manufacturers Association and it was anticipated that a number of their approved recommended practices would be suitable for passage through the sectional committee procedure and ultimate adoption as American Standards. The scope of the committee's activity was divided among sub-committees on the following subjects: nomenclature, tooth form of spur gears, helical gears, worm gears, bevel gears, materials, inspection, and power rating of gears.

The sectional committee has held regular meetings in connection with the American Gear Manufacturers Association activities, but to date only one report, that on spur gear tooth form for the $14^1/_2$ degree composite system and the 20 degree steel involute system, has received approval by the American Standards Association.

The sub-committees on nomenclature, spur gear tooth form, materials, and insepction of gears have held several meetings and have discussed several recommendations on these subjects. No real progress, however, appears to have been made.

The work on standardization of helical gears, worm gears, bevel gears, and the power rating of gears has been largely exploratory in nature, the practice apparently being not sufficiently crystallized for the establishment of national standards.

B16—Pipe Flanges and Fittings

Scope—Dimensional standardization (exclusive of screw threads) and designation of materials for pipe flanges, and flanged and screwed fittings for pipes carrying steam, gas, air, ammonia, water, etc. The standardization of face-to-face dimensions of ferrous gate, globe, angle, and check valves having flanged connecting ends and WSP ratings of 125 and 250 lb per square inch.

Chairman—Collins P. Bliss, Associate Dean, College of Engineering, New York University, New York City.

Secretary—Albert C. Taylor, 103 Park Avenue, New York City.

This sectional committee, appointed in 1922, has so far developed a series of American Standards on cast iron pipe flanges and flanged fittings for WSP of 125 and 250 lb per sq in.; malleable iron screwed fittings for WSP of 150 lb per sq in.; cast iron screwed fittings for WSP of 125 and 250 lb per sq in.; steel pipe flanges and flanged fittings for WSP of 250, 400, 600, 900, and 1350 lb per sq in. at 750 F; and cast iron long turn sprinkler fittings for HWP of 150 and 250 lb per sq in. These standards have been approved by ASA and published.

A proposed standard on cast iron pipe flanges and flanged fittings for WSP of 25 lb per sq in.

was recently submitted to the American Standards Association and a recommendation concerning its approval is being formulated by a special committee.

Proposed standards on pipe plugs of cast iron, malleable iron, cast steel, and forged steel; on steel base fittings for WSP of 250, 400, 600, and 900 lb per sq in.; and on steel companion flanges for WSP of 250, 400, 600, and 900 lb per sq in., have been developed by sub-committees of the sectional committee. Other sub-committees are working on cast iron flanged ammonia fittings, and on malleable iron or steel brass seat unions for a minimum steam pressure of 300 lb per sq in., respectively. A revision of the ratings of the standard steel flanges and flanged fittings is under consideration.

Work has also been done on center to face dimensions of iron and steel check valves for steam pressures below 400 lb per sq in., but one of the sponsor bodies, the Manufacturers Standardization Society of the Valve and Fittings Industry, has declared itself to be opposed to having work on this subject go forward.

B17—Shafting, Standardization of

Scope—Diameters of transmission and machinery shafting and tolerances on shafting stock; choice and proportions of shafting keys and tolerances for key stock; development of standard formulas and methods to be used in determining transmission shafting sizes.

Chairman—C. M. Chapman, Consulting Engineer, New York City.

Secretary—C. B. LePage, American Society of Mechanical Engineers, New York City.

Upon organization in 1920 under the sole sponsorship of the American Society of Mechanical Engineers, the committee proceeded with the development of Diameters and Lengths of Cold Finished Shafting (B17a-1924); Dimensions of Square and Flat Keys (B17b-1925); Dimensions of Square and Flat Plain Taper Keys (B17d-1927); Dimensions of Square and Flat Gib Head Taper Keys (B17e-1927); Code for the Design of Transmission Shafting (B17c-1927); and Standards for Woodruff Keys, Key Slots, and Cutters (B17f-1930).

In 1929 a survey of the desires of industry regarding the standardization of various other types of keys indicated that insufficient quantities of these were used to justify the development of a national standard. The committee's work, therefore, appeared to be complete. A tendency to produce equipment in the larger size units, however, has made a revision of the earlier standards desirable. In doing this the committee is making an effort to coordinate American practices with British and European keying practices in so far as such uniformity is practicable.

B18—Bolt, Nut, and Rivet Proportions

Scope—Standardization of dimensions, material, and nomenclature of rivets, hexagonal and square head bolts and nuts, slotted head bolts and machine screws; track bolts, carriage bolts, and special bolts and nuts for agricultural machinery; but not including the standardization of screw threads.

Chairman—Arthur E. Norton, Associate Professor, Harvard University, Cambridge, Mass.

Secretary—William J Outcalt, Standards Section, General Motors Corporation, Detroit, Mich.

Standards on small rivets; on wrench head bolts and nuts and wrench openings; on slotted head machine screws and wood screw heads; on track bolts and nuts; on round unslotted head bolts; on plow bolts; and on tinners', coopers', and belt rivets, have been developed and approved since this committee started its work in 1922. Work on stud and stud bolt dimensions, large rivets, set screws, and socket head cap screws is still in course of development. A draft standard on large rivets, completed some time ago, is now under revision following criticism of the draft. Quite recently a joint committee of three members of committees B18 and B16 (Pipe Flanges and Fittings) was appointed to give consideration to the difficulties said to be experienced by the builders of pipe lines in using the present American Standard sizes of wrench head bolts and nuts.

B26—Screw Threads for Fire-Hose Couplings

Scope—Threaded parts of fire-hose couplings, hydrant outlets, stand-pipe connections, Siamese connections, and all other special fittings on fire lines where fittings of $2\frac{1}{2}$, 3, $3\frac{1}{2}$, and $4\frac{1}{2}$ inches nominal diameter are used.

The American Standard on Screw Threads for Fire-Hose Couplings, approved in 1925, is being introduced into practice by a constantly increasing number of cities, resulting in improved safety conditions with respect to fire hazards.

B27—Plain and Lock Washers

Scope—Cast iron and malleable iron plain washers and steel lock washers and plain washers.

Chairman—C. W. Squier, Associate Editor, *Mechanical Engineering*, New York, N. Y.

In February, 1926, the standardization of plain and lock washers together with machine pins was undertaken by a sectional committee under the sponsorship of the Society of Automotive Engineers and the American Society of Mechanical Engineers. During the development of the sectional committee personnel, however, it became apparent that these projects could be more advantageously developed by separate sectional committees, since these prod-

ucts were not manufactured by the same companies. A recommendation by the sponsors to this effect was approved by the ASA and in May, 1928, the organization of the Sectional Committee on Plain and Lock Washers was completed. Sub-committees were formed to initiate the development of standard dimensions for plain washers and for lock washers. Manufacturers or large consumers of cast and malleable iron washers were not present at the meeting and it was therefore recommended that more information be obtained regarding the needs of these groups before action was taken.

The committee on plain washers has considered the proposed standard dimensions developed by one of its members. Some large user interests were not in complete agreement with the fundamental plan involved and it was accordingly recommended that lock washers of the type and sizes specified be made up and tested.

The sponsor bodies have not received any report of progress on the work of the sub-committee on plain washers.

B29—Transmission Chains and Sprockets

Scope—Formulation of American Standards for transmission roller chains and sprocket teeth, based on the standards already adopted by the Society of Automotive Engineers, the American Society of Mechanical Engineers, and the American Gear Manufacturers Association; and the study of the possibilities of standardizing, the so-called silent type of transmission chains and sprockets.

Chairman—F. V. Hetzel, 103 Dean Street, West Chester, Pa.

Secretary—G. M. Bartlett, 828 No. Main Street, West Lafayette, Ind.

An American Standard on Transmission Roller Chains, Sprockets, and Cutters was approved in 1930. Whether a standard on "silent" chains can be set up is now being considered.

B31—Code for Pressure Piping

Scope—Design, manufacture, test, installation, and operation of pressure piping systems.

Chairman—Edwin B. Ricketts, New York Edison Company, New York, N. Y.

Secretary—Frederick A. Lydecker, General Superintendent of Distribution, Public Service Electric & Gas Company, Newark, N. J.

Proposed standards have been worked out and published for criticism on power piping; on gas and air piping; and on oil piping. A draft standard on fabrication of hangers, supports, anchors, sway bracings, and vibration dampeners has reached an advanced stage. A section of this draft dealing with welding of pressure piping is being considered jointly by a sub-committee of the sectional committee, and a committee of the American Welding Society.

B32—Wire and Sheet Metal Gages

Scope—The standardization of a method of designating the diameter of metal and metal alloy wire, the thickness of metals and metal alloys in sheet, plate and strip form and wall thickness of tubing, piping, and casing made of these materials; and the establishment of a standard series, or standard series, of nominal sizes and of tolerances for wires, sheets, and strips.

Chairman—H. W. Hutchins, North East Electric Company, Rochester, N. Y.

No draft standard has as yet been worked out by the sectional committee which held its organization meeting in November, 1928.

B33—Screw Threads for Hose Couplings (Other than Fire-Hose Couplings)

Scope—Nominal values and manufacturing limits for the dimensions of screw threads for small hose couplings ranging from 1/2 inch to 2 inch nominal size, and for hose couplings, other than fire-hose couplings, with a nominal size larger than 2 inches.

Chairman—H. W. Bearce, Bureau of Standards, Washington, D. C.

Secretary—Arthur L. Brown, Engineer in Charge, Factory Mutual Laboratories, Boston, Mass.

A draft standard on screw threads for hose couplings, valves, nozzles, and all other fittings used in direct connection with hose intended for fire protection, or for domestic, industrial, or general service, in nominal sizes of 1/2, 5/8, 3/4, 1, 1 1/4, 1 1/2, and 2 inches, has been developed by a sub-committee and is now under consideration by the sectional committee. This draft is based on the standard previously adopted by the National Fire Protection Association, the National Board of Fire Underwriters, the Associated Factory Mutual Fire Insurance Companies, and the Manufacturers' Standardization Society of the Valve and Fittings Industry, and on a standard series of "iron pipe threads" recommended by the National Screw Thread Commission.

B36—Standardization of Dimensions and Material of Wrought Iron and Wrought Steel Pipe and Tubing

Scope—Standardization of the design, dimensions, and material of welded wrought iron pipe, of welded and seamless steel pipe, and of boiler tubing, including pipe and tubing for high temperatures and pressures.

Chairman—Harold H. Morgan, Manager, Rail and Fastenings Department, Robert W. Hunt Company, Chicago, Ill.

Secretary—Sabin Crocker, Engineering Division, Detroit Edison Company, Detroit, Mich.

Progress has been made in the development of a basic formula for the wall thickness of all sizes

of pipe and in the preparation of specifications for various types of pipe for which no specifications were in existence. No draft standards have been issued as yet.

B38—Refrigerators, Standards and Specifications for

Scope—Inside cubic contents; area and spacing of shelves; dimensions of ice doors; cooperation with the Division of Simplified Practice in establishing outside dimensions; the development of such standard methods of test as will be necessary to establish the data required in determining the rating of refrigerators; specifications covering the more important data essential to the rating of refrigerators and appropriate for inclusion on a nameplate defining the leading characteristics of the box; the setting up of standard grades or qualities for refrigerators; due consideration of questions of ruggedness and durability.

Such standards and specifications are to apply to household types of refrigerators and to such domestic-type refrigerators as are used in hospitals and hotels; but not to ice-making machinery or other specialized types of equipment.

Such standards and specifications are to apply both to refrigerators cooled with ice and to self-acting or mechanical refrigerators employing a self-contained refrigerant.

Chairman—Charles H. Roe, Electrical Testing Laboratories, New York, N. Y.

The standardization of refrigerators was initiated by the American Institute of Architects and the American Home Economics Association, jointly, in June, 1927. At a formal conference on the subject in March, 1928, a strong interest of diverse groups represented was shown. In April, 1928, ASA approved the undertaking of the standardization work and invited the Bureau of Home Economics of the United States Department of Agriculture and the American Society of Refrigerating Engineers to act as joint sponsors.

With the organization of the sectional committee in October, 1928, sub-committees were set up to develop standards under the following classifications: users' requirements as to temperature, humidity, layout, and arrangement, selection of data for nameplate; design details, dimensions, general requirements for material and construction; and test methods and forms. These committees are expected to develop standards under these heads in such form as eventually to become part of a complete standard on refrigerators.

The manufacturing interests were particularly anxious that an acceptable test code be made available at an early date.

The sub-committee on methods of test has accordingly given its subject continuous study and discussion, and has developed a test code for domestic refrigerators using ice, which has recently been approved by the sectional committee. The proposed standard method has been submitted to the sponsors for adoption, and approved by one of them, the Bureau of Home Economics.

In the meantime, informal discussions are proceeding in the sectional committee, with respect to the amount and nature of the information which is to be placed on the nameplate of ice refrigerators.

B40—Pressure and Vacuum Gages

Chairman—D. Engel, Edison Electric Illuminating Company, 30 Boylston Street, Boston, Mass.

Secretary—A. W. Lenderoth, Crosby Steam Gage and Valve Company, New York, N. Y.

Upon the recommendation of the American Society of Mechanical Engineers and a general conference representing 17 producer, user, and technical organizations, ASA, in June, 1930, authorized the formation of a sectional committee to develop standards and specifications for pressure and vacuum gages. The A.S.M.E. accepted sponsorship for this committee and on December 5, 1930, brought about its formal organization. A plan and scope committee was appointed to conduct a survey of the needs of industry on the subject and to subdivide the work among several sub-committees for preliminary development.

B41—Stock Sizes, Shapes, and Lengths for Iron and Steel Bars

Scope—The standardization of the dimensions of cross-sections and lengths of hot rolled and cold finished iron and steel bars having the following shapes: (1) rounds, (2) squares, (3) triangular sections, (4) hexagons, (5) octagons, (6) half-rounds, (7) half-ovals, (8) square-edged flats, (9) nut steel flats, (10) beveled cornered squares, including tolerances on the dimensions of such bars, (11) reinforcing bars. Nationally recognized standards are to be accepted where possible.

Chairman—F. H. Franklin, American Institute of Steel Construction, Inc., New York, N. Y.

The standardization of iron and steel bars commonly carried in stock by distributors or manufacturers of the product was proposed by the American Society of Mechanical Engineers in July, 1928. The A.S.M.E., as sponsor for numerous sectional committee standardization activities, had observed an apparent need for such standards. Their request, upon investigation by a representative special committee appointed for the purpose, was approved by the ASA Standards Council in October, 1928. The A.S.M.E. was designated to act as sponsor for the sectional committee, and in this capacity brought about its organization in June, 1930. The committee, in reviewing its scope of activity, has divided the work among sub-committees which will develop dimensional standards for

bars of the following sorts: hot rolled steel, cold finished steel, hot rolled iron.

The personnel of these sub-committees is now being completed.

B42—Leather Belting, Specifications

Scope—Specifications for vegetable-tanned leather belting, including raw material, construction, marking, physical and chemical tests.

The need for a national standard specification for leather belting was called to the attention of ASA in July, 1928, by the American Society of Mechanical Engineers. At a general conference of representatives of industry on the subject and upon advice of a special committee appointed by the conference, it was recommended that the project be undertaken under a sectional committee organization. The ASA Standards Council approved the proposal and on December 11, 1930, invited the American Society of Mechanical Engineers to accept sponsorship for the project. The organization of a sectional committee to undertake this work is now under way.

B43—Machine Pins

Scope—Dimensions of taper, split, straight, and dowel pins.

Chairman—Myron E. Steczynski, Chief Engineer, Knight Soda Fountain Company, Chicago, Ill.

The standardization of machine pins was undertaken in connection with the standardization of plain and lock washers in October, 1923. After organization of the sectional committee by the American Society of Mechanical Engineers and the Society of Automotive Engineers, joint sponsors for the project, it was decided, inasmuch as these products were not manufactured by the same companies and were not used for the same or related purposes, that they might to good advantage be undertaken by separate sectional committees. ASA approved a recommendation to this effect, and on October 11, 1928, a separate sectional committee was authorized for standardization of taper, split, straight, and dowel pins. A sub-group of this committee has recently developed a proposal, copies of which have been circulated to industry for review and criticism.

B44—Industrial Thermometers, Specifications for

Scope (*Tentative*)—Specifications and standards governing construction, tolerances, and method of tests for industrial thermometers of the mercury-in-glass type.

In the development of specifications for industrial thermometers under the auspices of the Federal Specifications Board it was found that several members of the Scientific Apparatus Makers Association were not satisfied with the requirements laid down by the government committee and were not themselves in entire agreement on the detailed constructional dimensions which would be most satisfactory for general use. This fact prompted these manufacturers in February, 1929, to request the American Standards Association to authorize the formulation of national standards and specifications for these instruments through a properly constituted representational procedure.

A preliminary survey of the desires of industry on the subject indicated considerable interest in the various groups concerned. However, since thermometers of these types are used in large quantities by only a very few industries, the interest of the several organizations in the field did not appear, at that time, sufficient to justify the expense of a conference by their representatives on the subject. It appeared to be the consensus of the user and general interest groups that specifications for the product should be proposed by the manufacturers. These could then be referred to the user and general interest groups for review and criticism prior to formal adoption. These suggestions were referred in April, 1930, to the Scientific Apparatus Makers Association for consideration and action. It is understood that they will be given further consideration at the next meeting of the Association.

B45—Foundry Equipment

Scope (*Tentative*)—Standardization of such foundry equipment as pattern plates and molding machine parts affecting interchangeability of patterns, flask pins and holes, general dimensions of flasks for jobbing work, ladle and ladle shank sizes, ladle sleeves, stoppers and nozzles, stock core print sizes, shapes and finish allowances, pattern markings, rapping plates, fillet sizes, and dowel pins for metal patterns and metal core boxes.

The decision that this project should be developed by a sectional committee sponsored by the American Foundrymen's Association and the American Society of Mechanical Engineers was taken by ASA in December, 1930. The committee is now being organized.

New Member of Sectional Committee on Gears

The American Society of Mechanical Engineers has announced the appointment of F. W. England as a member-at-large on the sectional committee on Standardization of Gears (B6). Mr. England is vice-president of the Illinois Tool Works, 2501 N. Keeler Avenue, Chicago, Illinois. He has been assigned to sub-committee 4 working on spur gear tooth forms.

Methods of Testing Fabrics Approved by ASA

The General Methods of Testing Woven Textile Fabrics, submitted to ASA under the proprietary sponsorship method by the American Society for Testing Materials, has received formal approval as American Standard L5-1931.

This standard method of test covers, to quote the scope of the project which was officially approved by the Standards Council at its meeting on December 11,

> "General methods of testing woven textile fabrics, exclusive of materials requiring special treatment (for which specific methods of test will be described applicable for that material and such special methods shall take precedence over the general methods), and exclusive of cord fabric used in manufacturing tires."

In a sense the new standard may be considered as a revision of the former American Tentative Standard Methods of Testing Cotton Fabrics (L2-1923) which was discontinued when it was found desirable to widen the scope in order to include specifications for tolerances for hose ducks and duck belts. A.S.T.M. Standard D230-27 defines tolerances as the

> "limits within which a textile must come in its specified characteristics in order that it shall constitute a good delivery on contract. They may be classified as the allowable limits of the quantitative characteristics of the fabric as defined in the specifications."

This use of the term "tolerance" is not logically consistent with the use accepted in limit gaging practice but represents an independent development of the ideas of the textile industry. In mechanical engineering practice the tolerance represents the zone between the limits within which a product may vary and still be acceptable.

Following the decision to widen the scope of the project, the activities of the committee were broadened in scope to include special textile products. It thus became apparent to the several groups that insofar as testing apparatus test methods, and tolerances were concerned they could meet on common ground to the advantage of all. The committee was, therefore, able to develop a general testing procedure, which, in 1926, was published not as a standard, but for its value as information.

A revision of this proposal was adopted by the A.S.T.M. as their standard D39-27 in 1927, and is now adopted as American Standard L5-1931 (25 cents per copy).

Line Insulators to Be Handled by One Committee

A consolidation of the projects on line insulators for voltages not exceeding 750 (C20) and power line insulators for voltages exceeding 750 (C29) has been approved by the ASA Standards Council.

This consolidation was originally requested by the sectional committee for insulators for voltages not exceeding 750 and had the approval of the A.I.E.E. and the NEMA who are joint sponsors for both projects. The future course of the work of standardization of insulators will be to add the following topics to the work remaining before the committee on power line insulators:

1. One-piece porcelain insulators
2. Strain insulators and spools
3. Threads for pins and insulators including gages, tolerances, etc.

The last-mentioned point is also to include a coordination between the threads commonly used on porcelain insulators with those used for glass insulators.

Code for Lighting Schools to Be Revised

The Illuminating Engineering Society and the American Institute of Architects, sponsors for the American Standard code for Lighting of School Buildings (A23-1924), have advised the American Standards Association of their decision to undertake a revision of the standard.

These two organizations will appoint representatives to form a special committee which will prepare suggestions for the revision of the code so that when the sectional committee is fully organized there will be something definite to place before it.

The cooperating organizations as listed in the 1930 Year Book have again been requested to appoint representatives on the sectional committee.

1931 Navy Specifications Index

The Bureau of Supplies and Accounts, United States Navy, Washington, D. C., has issued a January, 1931, edition of the "Index to Specifications Issued by the Navy Department for Naval Stores and Material." This index covers specifications for all types of supplies used by the Navy.

Use of Specifications in Purchasing Assures Uniform Quality

The volume on materials and supplies of the Library of Factory Management (A. W. Shaw Company—1915), although out of date in many respects, records a clear illustration of the value of standardization in a general transfer of purchasing activities from a rule of thumb to a scientific basis.

One case is cited of a perfume manufacturer who ran into serious difficulty because, due to an impurity in the alcohol used, the fragrance of the perfumes was quickly lost. In the readjustment which followed, the plant

"established a laboratory and set chemists to work standardizing materials and processes. When later the department head died, and the traditional methods seemed about to be lost, the formulas and specifications were there to take their place. And from that time production in this plant has rested not on guesswork but on laboratory methods. Material requirements are ascertained and standardized. These standards become specifications and are included in the contract. And by these standards, the purchasing agent sees to it that the supplier lives up to his bargain.

"Rules of thumb served well enough when production was measured on a one-man scale, buying in household quantities. In those days the proprietor, doing his own buying, inspection, and handiwork, could regard his first order merely as an experiment, and by skilled personal inspection could soon make certain that what he bought was what he needed. But in present-day production for national markets, with narrow border lines of profit and with world-wide sources of supply to draw upon, purchases by tons, representing fortunes in invested finances, must not be founded on guesswork. And fortunately, scientific knowledge of materials has kept pace with this need. The purchasing agent no longer needs to guess; he can make almost every important purchase conform to specifications and pass the searching microscopic eye for quality.

"Buying is, in fact, fundamentally a campaign against guesswork. The factory is rarely positive as to either the sort, quantity, or quality exactly suited to its needs. Under conditions of modern transportation, possible sources of supply may number thousands, affording a bewildering gradation of advantages for the purchasing agent to select from. Similarly, the trend of general supply and demand, as affecting prices and deliveries, presents a factor so complex that guesswork can only be minimized. And even after the purchasing agent has determined these matters, nothing short of the most exact specifications can express his wishes in so precise a way that the supplier cannot misunderstand them. Moreover, the latter may still blunder, may be misunderstood by *his* supplier, may allow too wide a variation in his standards of workmanship, may be tempted to substitute or slight or adulterate. Only exact specifications and tests will then enable the purchaser to 'nail' the error and force an adjustment. And with guesswork on any of these points, the purchasing agent is more or less uncertain regarding the price he should pay—open to the blunder of too low first cost, or of paying high prices for reputation only. . . . Buying right has come to mean buying with definite knowledge, worked out by definite methods. . . .

"It is in questions of kind, quantity, and quality, however, that the methods of precision have made the most headway against guesswork in buying. The origin of specifications usually lies in the fact that some difficulty has arisen in a process; some machine ceases to give satisfactory service; some structure fails; some material in use does not give good results. This difficulty results in an attempt to locate the cause. In other cases, a largely used product, furnished by different makers, is found to vary in quality. Sometimes it is desired to standardize certain practices and make them uniform in all the mills of the corporation, and to do so requires that the same quality of material be furnished and used in all cases. This development leads finally to the issuance of specifications.

"A fourfold advantage usually follows. The testing of samples and the working out of specifications, either in the factory or

with technical aid, in the first place lead the purchasing agent and the production men to determine their needs exactly. Often the factory heads have had only a vague idea of what they want. To get a sharply focused idea of the need eliminates guesswork and is the first rule of sound purchasing. In the purchase of several carloads of catalogue paper, this advantage was recently called to the attention of a factory executive in an unusual way.

"Instructions to the advertising man had been to make proper selection of paper and in cooperation with the purchasing agent to obtain bids from different paper houses by circular letter. In so doing he sent the form letter also to an industrial chemist, who, he had heard, was a paper expert. The very first reply was from the chemist. And instead of merely asking that he be consulted in the placing of the contract, he had criticized the purchaser's crude description of what he wanted.

"The publicity head had considered appearance, strength, weight, price, and the fact that half-tones, line drawings, and type would in many cases appear on the same page. To the specification of weight, the chemist added bulk; to appearance, color; to strength, durability and the service treatment demanded for the maximum number of half-tone screen lines to the square inch. Finally, he suggested that the quantity contemplated would warrant a 'mill run' and thus afford a paper especially adapted to the purpose in view.

"In the second place, exact knowledge of what is needed enables the supplier to get a clearly defined idea of what he is expected to furnish. Scientific standards allow neither that the buyer guess what the shop wants, nor that the seller guess what the buyer wants. Chemical research among metals, for instance, has resulted in specifications that define steel and alloy requirements more clearly than the average purchasing agent could possibly do in any other way.

"Such specifications, to mention the third advantage, not only focus the factory's requirements and furnish a standard to which the supplier can work; they also equip the inspectors with tests and measures by which they judge deliveries, in search of adulteration, substitution, and other errors. This, again, is a fundamental rule of sound buying. With many commodities, adulteration or substitution is difficult of detection, and therefore so tempting that specifications have been the buyer's natural recourse. Lard oil for screw-cutting machines, for instance, can be obtained in what is termed a 'mineralized' state or with a certain per cent of mineral oil added to cheapen the cost. When pure lard oil has been ordered, do you guess or do you know that you are not receiving the cheaper 'mineralized' product? Of the cases investigated by one purchasing agent, nearly fifty per cent have shown adulteration with either mineral or cottonseed oil. The latter adulteration is a particularly hard one to detect.

"Turpentine, too, is often adulterated with a percentage of mineral oil, usually a heavy naphtha, which will lengthen the drying period. Casual inspection will rarely protect the buyer against such conditions."

A case is cited of another adulteration which was avoidable by proper specifications and tests; viz., phosphor-tin alloy used in the manufacture of large and expensive valve castings. It turned out that lead had been substituted for a part of the phosphorus, on the assumption by the manufacturer of the alloy that the product would be used in bearings.

"If, for the services rendered," continues the book cited, "an adulteration does no harm, to eliminate guesswork enables the purchasing agent to specify the cheaper product and pay only for it. And if the adulteration is hurtful, it is better forbidden in the contract and detected by receiving room tests than left to guesswork and discovered running through the finished product. When it comes to adulterating what is purchased, the average manufacturer will prefer that his own experts, rather than those of his suppliers, plan the adulteration and award the saving.

"Finally, specifications and knowledge of basic elements furnish the purchasing agent with a key to prices. They put him at an advantage in considering bids, in bargaining, in arranging adjustments. By means of them, mixing to formula on a cost-plus basis has become a business, and by resort to this plan many purchasing agents obtain exactly what they want at the lowest price consistent with value. In the purchase of bronze alloys, for example, a manufacturer by this method consistently saves several cents a pound."

Specifications, it is pointed out, do not reduce purchasing to a clerk's job and their use does throw more rather than less responsibility upon the buyer, but such acceptance of responsibility by the buyer often makes for large savings, since no one can know so well as he what he requires, and he avoids overpayment for qualities that he may not need. The purchasing

agent thus being relieved, through the technologic backing behind him, of the necessity of guarding against misrepresentation, can spend his time doing that which he does best—studying markets, and combing the field of supplies for desirable bidders. For the reduction of risk which the buyer achieves by purchasing in part on the strength of his supplier's reputation and the assurance in such purchase that errors are more likely to be satisfactorily corrected when they do occur, the buyer

> "pays the premium the supplier must charge to cover the insurance for which his reputation stands. Purchase from favorably known firms does not mean buying by guesswork, but it does mean buying on faith. In emergencies, or for those supplies and materials which specifications and tests fail to cover, it is as a rule the best method. So the wise manufacturer when in doubt buys the well-known brand thoroughly backed with reputation, but the wisest manufacturer seeks economy by having specialists draw up specifications as largely as possible for all materials and lay down tests by which, when received, it can be determined if purchases conform. As the manufacturer in this way matches his true requirements against the market with precision, he determines scientifically, and perhaps once for all, that balance which assures a product of the lowest cost with the highest quality and the best service he can give his customers. Thus he equips his purchasing agent with an exact knowledge of what is required, and so places him that he can safely contract for it. If, in addition, he makes it the definite duty of someone to keep all specifications up with changing needs and changing markets, guesswork on the purchasing end is eliminated perhaps as far as is humanly possible."

Succeeding chapters in this book cite interesting illustrations of practical tests which act as a useful guide to buying and to control of product. Some valuable suggestions are made of short-cut methods of tests applicable to numerous common products. Fairly full treatment is given the manner of developing purchase specifications by large industrial consumers, including the reference of drafts to various experts in the plant, foremen of departments using the material, and manufacturers who will be asked to bid.

> "After criticisms are received from all those qualified to criticise, the provisional specification is remodeled so as to include all suggestions which are of actual value. In some cases criticisms conflict, but this is frequently due to local conditions and unimportant details. In the whole procedure there is one preëminent feature that seems worthy of careful consideration, namely, the greater the care, the more study and well-directed time and effort put upon the specification before it is issued, the less will probably be the difficulty connected with it after it has once become a part of the contract. Rational specifications represent the fruition of the studies of those who investigate the properties of such materials and those who handle and use these commodities."

It is essential, pointed out the author of this work, that for best results one should assign special responsibility to some one man in the organization especially qualified along this line, and it is suggested that large plants have a material engineer whose province is not only to accumulate the data for and draw up the specifications but also to supervise the inspection and tests of the material received. It is well said that anybody can write a specification but to prepare a satisfactory specification calls for especial ability.

> "In the course of time, however, by systematically saving and indexing every scrap of information bearing on specifications which he can find, including specimens of actual specifications and model specifications such as technical societies and trade associations publish, any live purchasing agent can make himself fairly competent."

It is noted that in one company which manufactures computing machines the specification work is regarded as so important that the president allows no specifications to be issued or to be altered in the slightest degree without having himself passed upon them.

It is well stated in the discussion on sampling and acceptance tests that

> "specifications are not drawn for the purpose of making it easy for irregular or carelessly-made material to be accepted. It is far better to make the limits of the specifications wide enough when they are first drawn, so that they will cover all the uncertainties of manufacture, and eliminate carelessness, bad judgment, or any other attempt to sell an inferior product at the price of a good one."

The interesting suggestion is made that while some manufacturers object to specifications for the products which they are to supply, others particularly request them, and some even consider difficult specifications a direct advantage as they eliminate the competition of inferior products.

"Opportunities for large economies in standardization also await the live purchasing agent. A buyer of this sort in a New England machine-builder's plant, within a month after replacing an 'old style' purchasing agent who spent most of his energies in dickering over prices, more than earned his salary by having the bolts and screws in the product fixed at a standard size and gage. Similarly, a purchaser in a large factory in the Middle West standardized the oil. Previously, seven different kinds of oil were used in the various departments, due to the prejudices of the men. By the use of an oil testing machine, he found the one best oil. The resultant saving netted several thousand dollars annually."

Progressive Building Managers Using Supply Specifications

The need for carefully drawn specifications for supply and maintenance materials of various types is indicated in the 1930 *Proceedings* of the National Association of Building Owners and Managers. The following is quoted from a paper by George N. Butz of the New York Telephone Company, in which he writes under the heading "Analysis and Standardization of Building Supplies:"

"Many valuable services are rendered Bell System Companies by the American Telephone and Telegraph Company. In the building operating job we gain the advantage of very favorable prices for cleaning supplies and utensils. This is made possible by the studies and results effected by their supply specialist who undertakes laboratory analyses, research, and testing. This work is supplemented by extensive field tests in Bell Telephone buildings under actual operating conditions.

"One supply item of our Bell System annual requirements approximating $70,000.00 has been reduced in price, principally through laboratory work, from $1.50 per gallon to 59 cents per gallon. We substituted with very satisfactory results an article at 41 cents per gallon for one that formerly cost $3.04 per gallon.

"Analyses of numerous proprietary cleaning preparations revealed many disguised ordinary cleansing agents selling at many times their market value. Even more important is detection of extremely effective preparations which contain highly caustic or strongly acid ingredients. Such preparations would seriously damage building equipment if used regularly or frequently. There also are factors of moisture content and bulk which from an economic standpoint must be considered. Liquid soap and cleansing powders of high moisture content do not provide as much cleaning value per unit as those of lower moisture content. Bulk in cleansing powders makes for economy as these materials are purchased on a weight basis and are usually used on a volume basis.

"We formerly purchased liquid hand soap, 15 per cent soap solution in 52 gallon drums. We now buy liquid soap base, 40 per cent solution. We do not pay transportation charges on water, but add it at our buildings and get the same result at approximately 20 per cent of the former cost.

"Purchases based on pooling of requirements, and, most important, through standardization has made possible very substantial reductions in supply expense.

"The officials of our national association have an important responsibility to assume in this matter of standardization and purchasing. Their prompt attention and vigorous treatment will be reflected in profit to their members."

Proposed Federal Specifications

The following proposed revisions of federal specifications have been received by the ASA Information Service for comment and criticism and are available for loan to Sustaining-Members:

	Proposed Revision
Varnish; Asphalt	F.S. 19
Enamel; Water-Resisting, Red	F.S. 66
Paint; Lithopone, Interior, Gloss, Light Tints and White	F.S. 67
Paints; Titanium-Zinc, Outside, Ready-Mixed and Semipaste, White	F.S. 278
Paints; Lithopone, Interior, Flat and Eggshell Finish, Ready-Mixed and Semipaste, Light Tints and White	F.S. 21b
Packing; Asbestos, Rope, and Wick	F.S. 487
Packing; Fiber, Hard, Sheet	F.S. 486
Packing; Flax	F.S. 101c
Packing; Rubber, Cloth-Insertion	F.S. 110a
Packing; Spiral, Gland, Low-Pressure	F.S. 104a
Pipe; Wrought-Iron, Welded, Black and Galvanized	F.S. 242a